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945 — Journal Section of the American Society of Heating and Ventilating Engineers

Raymond R. Tucker writes this month about a smoke elimination program that works. This photo, taken at 15th and Market, St. Louis, at 10 a.m., December 11, 1937, indicates the smoke problem that city faced

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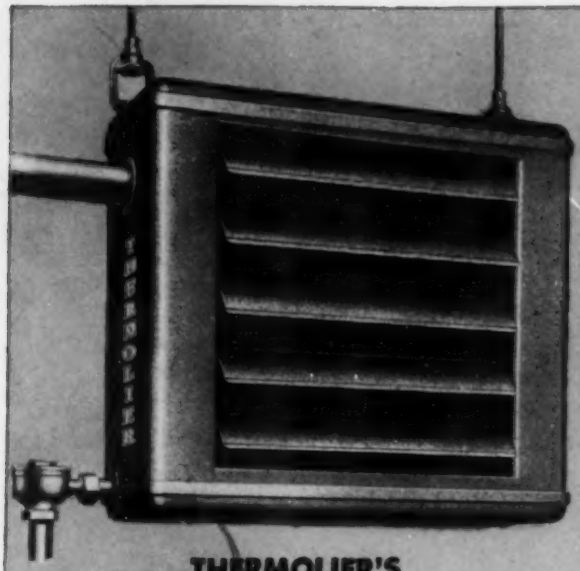

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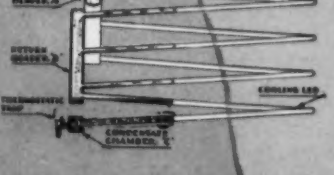

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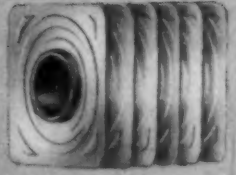

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STOKER MAKERS SEE BIG FUTURE

The stoker industry held its first postwar conference last month in form of the 28th annual meeting of the Stoker Manufacturers Association at the Stevens hotel, Chicago, which was devoted very largely to postwar plans and reconversion problems.

A national advertising and sales promotional campaign for the industry was presented and discussed. While the program was not approved, the association members are to study it carefully and further meetings will be held in the near future. The program as proposed by the advertising committee features an industry-wide national advertising campaign stressing the advantages of automatic coal heat.

It was revealed that stoker manufacturers in general will be able to step up their production of domestic stokers gradually during the balance of this year and that 1946 production and sales may be on the highest level in the history of the industry. Some of the materials bottlenecks which have been experienced since the fall of 1944 have been eliminated but the foundry situation is hampering the immediate prospects of a greatly accelerated production rate for domestic stokers. In discussing this problem, J. M. McClintock, retiring SMA president, said that a foundry was probably "the last place in the world people will want to work."

There was optimism on the future of stokers for heating and commercial and industrial purposes. Officers of the association pointed out that competition between the manufacturers of different types of fuel burning equipment and the producers of coal, gas, and oil will be more active and more aggressive than ever before and that intelligent planning and capable execution of sales and advertising plans will be necessary to secure a fair share of the billions of dollars which will be used by the public for the purchase of necessities, equipment, and all kinds of commodities during the coming years.

Walter Sormane, sales manager, Cleveland Engineering Works, was elected president of the SMA, succeeding Mr. McClintock, manager, stoker division, Illinois Iron and Bolt Co., who had served as president for four years. George W. Graham, president, Eddy Stoker Corp., was elected vice-president, succeeding Mr. Sormane, and Claude A. Potts, vice-president, U. S. Machine Corp., was elected secretary-treasurer, succeeding Mr. Graham. Marc G. Bluth was reappointed executive secretary.

Mr. Sormane, Mr. Graham, and Mr. Potts were also elected to the board of directors with Mr. Sormane as chairman. Other members of the board are C. T. Burg, vice-president, Iron Fireman Mfg. Co.; F. H. Herndon, manager, stoker division, Link-Belt Co.; Mr. McClintock; W. L. Schultz, vice-president, Anchor Stove and Range Co.; H. E. Sill, vice-president, Muncie Gear Works, Inc.; and Milton A. Young, sales manager, Catskill Metal Works.

Mr. Young is also chairman of the association's anthracite section. In a frank and lively report for this section, he said that some anthracite producers apparently would like to see a manufacturer come out with a "Buck Rogers, atom smashing, rocket tube" to utilize only certain sizes of their product, but that in his many contacts with stoker manufacturers he could find no evidence of such an intent. His report stressed the many advantages of stokers to both the anthracite producers and the consumers.

ESTIMATE POSTWAR OUTPUT DOUBLE PREWAR FIGURE

Civilian peacetime business and employment at the Westinghouse Electric Corp. in the first three postwar years following reconversion promise to approximate 1941 levels, A. W. Robertson, chairman, has disclosed. Production in that year amounted to $369,094,000 and employment averaged 71,000, both figures being the highest in the company's history up to that time. The estimated postwar business would be about double the average annual output of the company for the five prewar years of 1936 through 1940.

Mr. Robertson made public excerpts from a report to the company's employees on plans for changing from war to peacetime production, involving appropriations for improvements of more than $23,000,000 made since the first of the year and another $4,500,000 planned for the remainder of the year.

Mr. Robertson presented a breakdown of planned postwar expansions and activities as they will affect the various plants of the company throughout the country:

East Pittsburgh, Pa.: Expenditure of $2,000,000 is contemplated this year for rearranging factories and rehabilitating equipment and other manufacturing facilities. Plans call for another six or seven million dollars to be spent in 1946.

Appliance Division (Mansfield, Ohio, and East Springfield, Mass.); Expansion program calling for $12,300,000 approved this year to increase appliance output by 50 per cent. New buildings, tools, and equipment to be added at each place.

Home Radio Division (Sunbury, Pa.): Appropriations since January total $831,000 and an additional $150,000 is planned before the end of the year.

Industrial Electronics Division (Baltimore, Md.): Increased production of high frequency heating apparatus as well as radio transmitting and related equipment.

X-Ray Division (Baltimore, Md.): Doubling of plant capacity planned.

Aviation Gas Turbine Division (South Philadelphia, Pa.): Newly organized division to carry on gas turbine and jet propulsion work in peacetime.

Steam Division (South Philadelphia, Pa.): Appropriation of $738,000 planned for new facilities in addition to $140,000 already provided for major rearrangement of division's foundry at Attica, N. Y.

Air Conditioning Division (Jersey City, N. J., and Boston, Mass.): Recent acquisition of the Sturtevant company of Boston together with previously owned facilities at Jersey City gives Westinghouse "the most complete organization in the air conditioning and air handling industry."

Lamp Division (headquarters at Bloomfield, N. J.): Sum of $4,590,000 made available for new facilities for making incandescent lamps, fluorescent lamps, tungsten and

molybdenum wire, lamp bases, etc. Additional appropriation of $635,000 planned. Lamp business of Ken-Rad Tube and Lamp Corp. at Owensboro, Ky., recently purchased. New glass plant in production at Fairmont, W. Va.

Elevator Division (Jersey City, N. J.): $931,000 provided for expansion and improvement since first of year. Appropriation of an additional $668,000 contemplated before the end of the year.

Transformer Division (Sharon, Pa.): Business expected to run 25 per cent ahead of 1937, best prewar year. Plans record-size transformer for an experimental transmission line that would carry voltages higher than any existing line in the country.

Small Motor Division (Lima, Ohio): More than $2,000,000 appropriated to equip plant for manufacture of high torque and ironer motors, hermetic motors and controls, and to purchase government owned tools and rearrange existing facilities for civilian work.

Meter Division (Newark, N. J.): Appropriation of $442,000 made for purchase of new equipment and changing of factory layouts.

Bryant Electric Co. (subsidiary at Bridgeport, Conn.): Appropriation of $685,000 made for land and new buildings.

District Manufacturing and Repair Divisions: Reconversion plans involving expenditure of nearly $600,000 this year have been completed.

O.K. TO THROW FUEL OIL COUPONS IN WASTEBASKET

With the end of gasoline and fuel oil rationing, all rationing coupons and certificates for these products held by the trade or consumers became valueless and may be disposed of, OPA said August 24.

PRODUCTION RATE HIGHER THAN BEST PREWAR YEAR SEEN

With demands for its peacetime products reflecting four war years of shortages, Minneapolis-Honeywell Regulator Co. expects to be back in its regular production at a rate equivalent to its best prewar year by mid-September, company officials said last month. By the end of October, the company's production rate is expected to be 30 per cent greater than its best prewar year, providing essential raw materials are available in the necessary quantities.

Harold W. Sweatt, president, feels that the company "has bigger and broader opportunities for future growth than at any time in its history."

THE Editor's Pages

Election of Henry F. Dever as president of the Brown Instrument Co., a subsidiary of the Minneapolis-Honeywell Regulator Co., was announced last month by Harold W. Sweatt. Mr. Dever, who has been serving as vice-president in charge of engineering for Minneapolis-Honeywell, succeeds Charles B. Sweatt as president of Brown. The latter, vice-president and director of Minneapolis-Honeywell, has withdrawn from Brown and will henceforth devote his entire attention to supervision of the expanded sales activities of the Honeywell organization and its subsidiaries.

Engineering activities of the parent company will be under the direction of W. J. McGoldrick, who has been vice-president in charge of aeronautical engineering. Under him will be consolidated the company's engineering activities in the domestic and industrial heating and air conditioning controls field, and the operation of the aeronautical engineering department.

"REPAIRADISE INN"

Matinee movies at an air base in India are presented three times a week in the darkened lounge of the Red Cross "Repairadise Inn" club, simply but effectively "air conditioned" for the purpose. To keep the audience from sweltering in the mid-afternoon heat, kuskus—a reed-like plant—is tied together in mats, which are thoroughly wetted down. Fans blow air through the hanging mats, and evaporation of the moisture cools the room. Automatic "drippers" attached to tanks of water keep the kuskus wet.

POSTWAR EXPANSION TO DOUBLE FACILITIES

The Trane Co. has announced a postwar expansion program that will more than double its present manufacturing facilities.

A major part of the program consists of building a new addition to the main plant that will increase the size of that plant by 40 per cent. This will permit the fabrication of heating and air conditioning units on an assembly line basis. It will also provide greater facilities for the production of refrigeration and special heat transfer equipment. A second new building is being constructed on these premises to house factory office workers.

To further the expansion, the company has purchased the large factory building which it leased during the war for the production of heat exchange equipment for airplanes. After extensive remodeling and new construction the area will be used for the production of heating specialties.

It is anticipated that expansion will call for the employment of approximately twice as many workers as the company employed during peak prewar years.

SCHMITT HEADS EMERSON ELECTRIC

Oscar C. Schmitt has been elected president of the Emerson Electric Mfg. Co., succeeding W. Stuart Symington, who was appointed by President Truman and confirmed by the Senate as Chairman of the Surplus Property Board. Starting in a minor capacity in the advertising department of Emerson Electric in 1910, Mr. Schmitt has successively held almost every major post in advertising, sales promotion, sales and executive management in the organization.

JOHN B. BERRYMAN, CRANE CHAIRMAN, DIES

After being with Crane Co. for 53 years, John B. Berryman, chairman of its board of directors since 1935, died last month at the age of 83. Mr. Berryman started as a bookkeeper in the supply company that later became Crane's Minneapolis branch.

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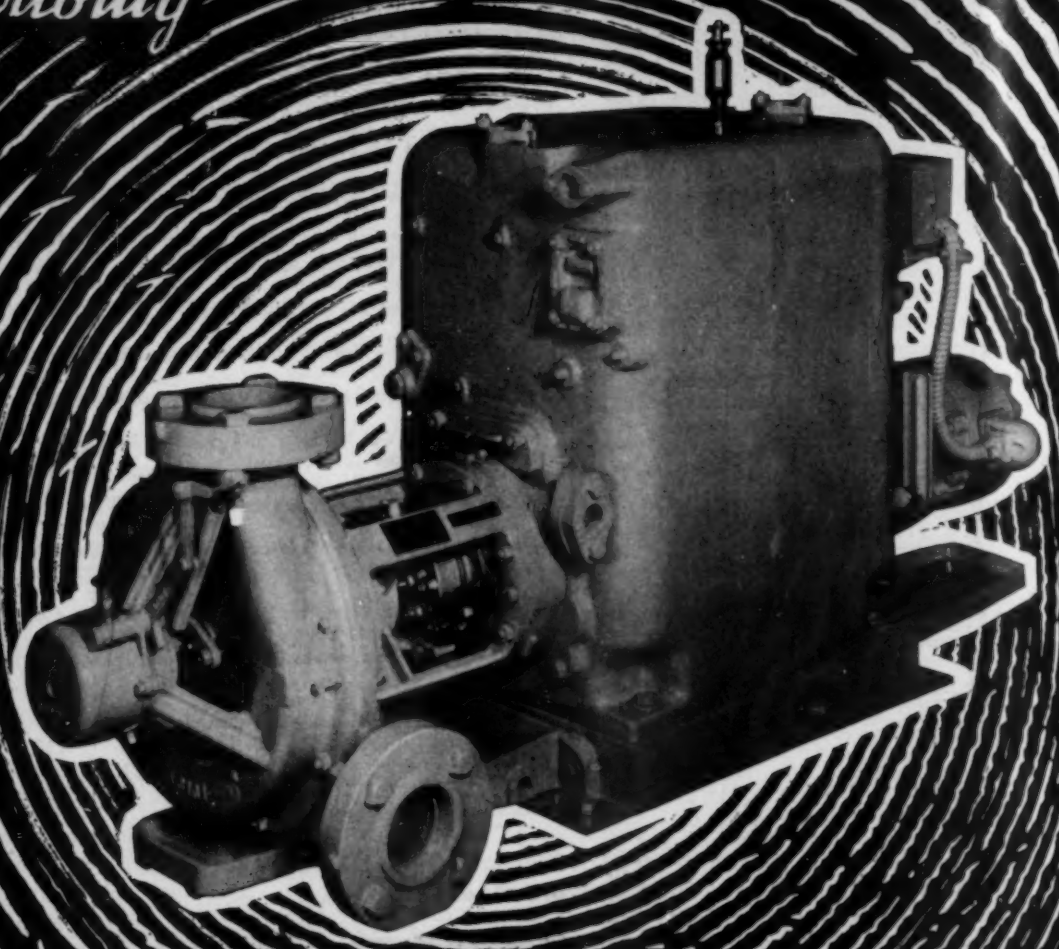
Centralized Heating Economy



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This unusual pump needs no electric current, cutting out greatest item of pump operating expense.

More important, this pump insures absolutely uniform circulation in system. That means continuous steam economy.

Simple, compact, one moving element, no wearing parts, no internal lubrication. Bulletin No. 203 gives the facts. Your copy is waiting.

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A SMOKE ELIMINATION Program THAT WORKS

Raymond R. Tucker Gives Discussion of Smoke Elimination in St. Louis

WIDE INTEREST has been shown in the St. Louis smoke elimination program, for many cities face the same problem, and smoke abatement activities are very much a part of postwar planning. The series of articles of which this is the first part will discuss the entire subject in thorough-going fashion . . . future installments will cover the smoke ordinances, what they contain, and the reasons for certain provisions; the codes for installation of fuel-burning equipment, and the technical reasons for adopting the various code requirements; enforcement problems of the ordinances and how they have been solved; and a summarization of the complete program, projecting it into the future. . . . Professor Tucker, the author of these articles, is well-qualified to write on smoke elimination, for he has been intimately concerned with the program in St. Louis. Now head of the department of mechanical engineering at Washington University in that city, he was smoke commissioner of St. Louis from 1937 to 1942. He is a member of the American Society of Mechanical Engineers. In addition to many talks on smoke elimination before various groups in St. Louis, he has also discussed the program at engineering meetings in cities where it is hoped to inaugurate similar projects

---

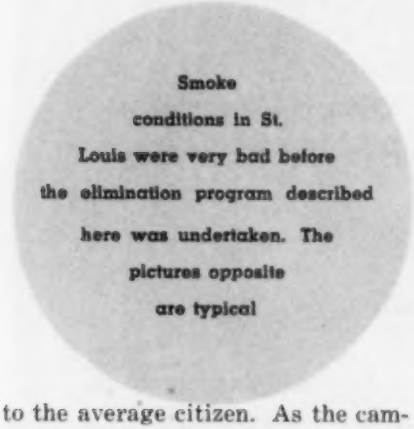
ST. LOUIS is situated in the vicinity of one of the largest coal deposits in the United States. This is a high volatile coal and, unfortunately, has the characteristic of being a very smoky fuel. It has been stated, and perhaps rightly, that the growth of St. Louis was directly dependent upon this abundant supply of energy. However, as the city grew, this fuel—the cause of its growth—was rapidly becoming the source of its destruction.

To delve into the early history of smoke abatement in St. Louis would be futile because it would not bring to light anything which was not known to many communities situated in similar circumstances. You would find that a series of ordinances had been passed creating a department, or appointing some individual or group of individuals, to solve the smoke problem. The public feeling which caused the passage of these ordinances would then subside. St. Louis, as many other cities, believed that the air could be purified by legislation alone. After each unsuccessful attempt, a feeling of apathy descended upon the community and for a period of three to five years nothing would be done. Then conditions would become so severe that small groups of citizens would again become aroused and a new attempt would be made. These attempts were not successful because they either failed to realize (or saw fit to ignore) the weaknesses of all previous attempts and the necessity of attacking the problem at its source.

In 1925, with this history, a fresh start was initiated. A group of citizens, known as the Citizens Smoke Abatement League, solicited funds and obtained pledges amounting to $200,000. Their attempt was to be one wherein the general public would be educated to the advantages of the elimination of smoke. A competent staff was employed, and literature distributed; talks before civic and fraternal organizations and personal contact were the basis of this educational program. A firing school was started in the central portion of the city and instructions were given to individuals or groups of individuals in the proper method of firing typical equipment used in St. Louis.

Instructors were sent to various neighborhoods, and housewives were assembled to receive instructions in proper firing methods. Research revealed that it was costing every man, woman, and child in the city anywhere from $20 to $30 a year for the privilege of living in a smoke-laden atmosphere. Soot surveys were made showing the quantity of soot in tons deposited on the city each year. This campaign was continued for a period of two years.

While in progress, a survey indicated there was a material reduction in the quantity of smoke discharged into the atmosphere; this, however, was not readily apparent



to the average citizen. As the campaign tapered off, interest waned and St. Louisians returned to their slovenly habits of firing. It proved conclusively that you could not solve the smoke problem by education alone. Following this attempt, the Department of Smoke Regulation practically ceased to exist, and in the year 1933 there was only one man employed to control the emission of smoke from more than 150,000 stacks.

Clarify the Air

With the change in city administration in 1933, a meeting was called to discuss the elimination of smoke, and as the result of that meeting the writer was appointed the chairman of a committee to consider the smoke problem. This committee, after various meetings, presented a report to the mayor, the gist of which was that the elimination of smoke would be dependent to a great extent upon the development of a smokeless fuel from Illinois coal. Subsequent to the presentation of this report, the writer was offered a position by the mayor as his secretary. In making this offer, the mayor said it was his desire to have his administration clarify the air as a previous administration had clarified the water, and he wished the writer to accept this position so that this work could be prosecuted. The writer accepted this position and was sworn in August 1934.

During the discussions on the proper method to be used in accomplishing our objectives, it was agreed (1) that any solution proposed had to be divorced from politics; (2) that public opinion had to be aroused to the point that the people would be willing to take the necessary steps to correct the evil; and (3) that any program proposed had to come from an unbiased, nonpartisan source. With these thoughts as a background, an ordinance was passed appropriating $7500 for the employment of the Bureau of Mines to make a survey of the situation in St. Louis and to recommend corrective measures. The bureau (although willing to make the survey) stated that it was a fact-finding body, and would make no recommendations — it would obtain the facts but would not recommend corrective measures. This was unsatisfactory because corrective measures would have to be of a drastic nature, and we desired an authority that was unbiased to make these recommendations. At the suggestion of the bureau, we then employed a man well known in smoke work to make this survey. This was done and his report was more or less in line with the policy that had been pursued in the past, viz., educate the people in proper firing methods and endeavor to encourage the coal operators to produce a smokeless fuel. This was not what we desired.

At the risk of encountering criticism, we injected a new thought. Taking as the basis of our thought the clarification of the water, we came to the conclusion that the only means of solving the smoke problem in St. Louis would have to be along similar lines. To illustrate, the water in the city of St. Louis is taken from the river, treated, clarified, and analyzed. When it is found to be potable it is then distributed to the citizens for their consumption. One can readily realize the lack of success that would attend the purification of any water if the raw water were distributed to individual homes and instructions issued on the best method of clarification and purification.

The Coal Washing Clause

This latter process, however, was the system we were employing in the use of fuel. Any fuel could be delivered to any individual whether it was adapted to his equipment or not. Then it was suggested that we issue instructions to these individuals on the best method of utilizing this fuel. True, there are many who would take these instructions seriously and endeavor to follow them; however, the vast majority would ignore them. Furthermore, the type of fuel that was being delivered made it practically impossible to do a satisfactory job unless an unreasonable amount of time was used in firing this fuel. The report of the expert did not contain any provision with reference to the control of the fuel. So the writer suggested that we accept the report of the expert we employed, with one condition: that we incorporate in his recommendations a clause that would enable us to control the type of fuel being used in the city of St. Louis. This resulted in the well known "washing clause." This requirement created considerable furore.

At no time did we claim that the washing of fuel would eliminate smoke. It was claimed, however, that the washing of coal would reduce sulphur and fly ash; produce fuel of uniform quality with higher calorific value which would adapt itself more readily to underfeed stokers; and give a fuel with a higher fusing point of ash, thus improving the fuel bed conditions and reducing clinker trouble. To those accustomed to using coals containing low ash and sulphur content, the necessity for a provision of this character may seem preposterous. It was not unusual for the city of St. Louis to receive from its adjacent fields coals containing as high as 30 per cent of ash and 5 to 6 per cent of sulphur —consequently some steps were essential to curb the use and pro-

duction of fuel from this source. Hidden behind this washing clause was a more potent reason. This provision, if enacted into a law, and if constitutional, would enable us to control the fuel at the source. Boycotts were threatened by various communities in Illinois. Newspapers said that we were imposing hardships upon the Illinois population without obtaining the desired results. There was, however, one outstanding engineer in town who upheld our position. We would not reveal at the time the real motive behind this clause. If we had, we would only have been placing ammunition in the hands of our opponents.

An amusing incident occurred with reference to this provision. It was realized that it would provoke opposition, and that no matter how perfect the wording of the law might be there would be many who would desire to change it. So the original section in the ordinance required all fuel to be washed, irrespective of size. Those opposing it were horrified at such an impractical proposal, and finally offered to assist in its preparation! This section was subsequently criticized as being too severe, even though the operators had approved. It was not too severe, because the average ash content of face samples of coal which was being delivered to St. Louis came within the requirements of the ordinance.

Division of Smoke Regulation

An attempt was made to locate the new division of smoke regulation in the health department because the police powers of the health department are very broad. However, the charter of the city of St. Louis would not permit this. Previous to this time the smoke inspectors were under the jurisdiction of the boiler and elevator department, and their time was used interchangeably in inspecting boilers, elevators, and smoke. This was thought to be a very poor administrative setup because it allowed too much buckpassing and evasion. So the report of the expert, with the addition of the washing clause and with the creation of a separate division, was used as the basis of an ordinance and those provisions became law on February 11, 1937.

Within a period of 90 days, suit was filed in a federal court by a coal producer requesting an injunction against the city restraining it from enforcing this ordinance. At the preliminary hearing this demand was denied, and the judge stated the police powers of the city were such as to justify the use of any reasonable means for abatement of the smoke nuisance. The case was then dropped and no further attempt was made to obtain an injunction with reference to the washing provision of the ordinance.

In the meantime the Joint Engineering Council* had been invited to select a smoke commissioner. After interviewing many candidates, one was chosen but he withdrew his application.

The writer had originally refused the office of commissioner because he felt he had been so active in fostering passage of the ordinance that his appointment would not be received in the proper light. The Joint Engineering Council, after another attempt to obtain a smoke commissioner, again requested the writer to accept the position. As it was now apparent that the writer did not support passage of the ordinance with the sole purpose of creating a job for himself, he accepted and was sworn in September 15, 1937.

An illuminating aspect of the St. Louis smoke problem was forcibly brought to the attention of the new commissioner shortly after his appointment. As guest at the annual dinner of a quasi-civic organization, he was introduced to those attending — approximately

*The Joint Engineering Council was composed of the chairmen of the local sections of various national societies as well as the president of the Engineers Club.

1000 in number. Upon his introduction this group laughed. It was evident that their mental attitude toward the subject was such that they believed it not only impossible of solution but seriously doubted the political ability of any administration to endeavor sincerely to solve the problem. Their attitude was excusable because smoke had been very much of a political football in the past. This, of course, was not encouraging. It did indicate the immense amount of work necessary to create favorable public opinion.

Provisions of the Ordinance

The ordinance that was passed on February 11, 1937, contained the usual provisions creating a division of smoke regulation, the appointment of a commissioner, and securing the necessary personnel. It defined "dense smoke" and ash content of the fuel, created an appeal board, and outlined the method of procedure for issuance of necessary permits and certificates of operation. It prescribed penalties for violation.

The section outlining specifications of fuel as far as ash content and sulphur content were concerned was, of course, the meat of the ordinance. The enforcement of this provision presented many difficulties. To accomplish the enforcement, a companion ordinance was proposed regulating the importation, storing, hauling, and distribution of fuel within the city of St. Louis. It empowered the commissioner to license all fuel dealers, and required them to furnish a $1000 surety bond before such licenses could be issued. It furthermore contained a provision which permitted the Board of Public Service to revoke the permits provided any fuel dealer was convicted of violating any law pertaining to handling of solid fuel. This ordinance was passed and became law October 22, 1937.

Licensing of Fuel Dealers

The importance of the washing clause as well as the licensing of fuel dealers cannot be stressed too much. It can be readily seen that the enforcement of these two provisions would bar certain mines from shipping fuel to the city of St. Louis. To aid fuel dealers in adhering to the provisions of the ordinance, a list of acceptable sources of supply was prepared. All mines delivering coal to the city of St. Louis appeared on the first list. They were then notified that they had a period of 30 days to submit to the division of smoke regulation an analysis of their fuel made by a competent testing laboratory, certifying that the fuel as sold contained less than 12 per cent ash, and that the mine possessed the necessary equipment to produce fuel containing less than 12 per cent ash. At the end of 30 days this list was revised and the names of those not submitting this analysis and statement were deleted. With these additional ordinances and the amendment of other ordinances which conflicted with the division, steps were then taken to enforce the ordinance.

During this time it was of course necessary to obtain the personnel to operate the department. The Joint Engineering Council was requested to prepare an examination which they thought a competent smoke inspector should be able to pass. The date of this examination was publicized, and on the day of the examination the questions prepared by the council were delivered to the examiners. Upon completion of the examination, the papers were turned over to the council to be corrected. By this method we obtained men for inspectors who were highly competent and capable of carrying on the work of the department. The smoke commissioner reserved one right—that he could reject a man on the basis of personality.

It was realized the results produced from the enforcement of the ordinance would not be apparent to the average citizen because the largest percentage of smoke was being made by the domestic user who was exempt under the provisions of the ordinance. The only absolute control we had was over the installation of new equipment above 1000 sq ft of direct steam radiation or equivalent load. When the smoke commissioner's office insisted that domestic installations below 1000 sq ft of steam radiation use mechanical fuel burning equipment or smokeless fuel, he was overruled by the appeal board, which stated the commissioner did not have authority to make such demands.

Stoker, Oil Burner Groups Cooperate

Considerable difficulty was encountered in obtaining the mechanical fuel burning equipment men to adhere to the provisions of the ordinance, which required issuance of an installation permit and operation certificates on the payment of a fee. Their experience in the past had indicated to them that the payment of this fee did not result in obtaining inspection service. Due to this lack of supervision, many installations were being made purely upon a competitive basis rather than upon a sound engineering basis. To overcome these objections, the smoke commissioner met with representatives of the St. Louis Stoker Association and suggested to them that a set of

Smoke elimination clears the atmosphere. This photo was taken at 2 p.m., April 14, 1941, looking southeast from the Civil Courts building

Another view showing elimination of smoke. This one was snapped at 11 a.m., April 16, 1941, northwest from the Civil Courts building

rules and regulations be drawn up to govern the installation of stokers. With tongue in cheek, they agreed to this. The stoker code was published September 16, 1938. A similar procedure was followed with the St. Louis Oil Burner Association. This code was published in January 1939. Both these codes have proved to be very satisfactory, and have subsequently been enthusiastically endorsed by both these associations.

As a further aid in the enforcement of the provision of the ordinance pertaining to the issuance of the necessary permits and certificates, a new ordinance was passed. It compelled the seller of the equipment to give the name and address of the purchaser of all fuel burning equipment. It further empowered the commissioner to examine the records, books, and papers of these concerns in order to obtain the names of purchasers.

Commissioner Investigated, Pestered

Enforcement of the ordinance was resisted by some, and brochures were even distributed within a radius of two miles of the commissioner's house insinuating that the commissioner was dishonest and was showing favoritism for monetary considerations. The Department of Justice was also notified that the commissioner of smoke regulation was interfering with interstate commerce. They sent their investigators into the city and checked his activities. Rumors began to be heard that the commissioner was receiving $10 for each piece of mechanical fuel burning equipment that was installed, and that he was receiving 10c on each ton of coal that was being delivered to the city of St. Louis. (A lucrative position if the stories were true, because over 4,000,000 tons of coal was being used in St. Louis each year!)

New and trick preparations appeared which were supposed to be the solution to the problem. When the commissioner refused to accept them the Federal Trade Commission was notified and they in turn came to St. Louis and investigated the details of the office as well as the activities of the department. The inspectors were accused by individuals of recommending certain types and brands of coal, and of putting on pressure in order that certain types of mechanical fuel burning equipment would be purchased. Whenever an inspector was accused, the commissioner requested the individual making the accusation to come to his office in order to give more details. When he came to the office he was confronted with the inspector, and it was indeed a happy circumstance that no accusation against any one in the department was ever substantiated. The commissioner was threatened from time to time by various interests that they would get his job if he did not cease his activities. It was the policy of the commissioner, when these threats were made, to call the mayor's office and make an appointment for the interests involved. Without exception they were told by the mayor to follow the regulations of the commissioner.

Another annoying habit of those opposing the ordinance was to call insurance men, express companies, cleaners, automobile salesmen, and various other types of business, and tell them to call at the commissioner's home at an appointed time, usually Saturday afternoon. This influx of visitors was, to say the least, irritating.

The ordinance contained a provision which permitted the commissioner to seal boilers if ordinance violations were reported against the equipment. At the end of the heating season owners or agents were notified that the boilers would be sealed, and they were sealed. At one time the commissioner had filed against him seventeen injunction suits in the circuit court seeking orders to restrain him from enforcing this provision of the ordinance. None of these suits was successful.

As indicated in the early part of this article, our proximity to the Illinois coal fields had always been an impediment to the successful solution of the smoke problem in St. Louis. It had been suggested many times that Illinois fuel should be processed and made smokeless and that increased quantities of such fuel be made available. To further this program, the mayor and the smoke commissioner, on February 1, 1939, appeared before the legislature of the state of Illinois, and sponsored an appropriation of $300,000 for a research program to develop new types of smokeless fuel from Illinois coal. This money was appropriated, but up to the present time no commercial results have been obtained from the appropriation.

Educational Campaign Conducted

Throughout this whole period a very active and intensive educational campaign was being conducted. Business houses were solicited for contributions for the erection of billboards. One hundred billboards were put up for a period of three months. Pictures depicting the evils of smoke, and appropriate slogans, were placed upon these boards. The names of

sponsors appeared upon the bottom of the boards. The advertising company rented these boards at cost. Talks were continually being made over the radio and the commissioner appeared before luncheon groups, fraternal and civic organizations, parent-teacher associations, etc., outlining the objectives and endeavoring to secure their cooperation and support. Pamphlets were distributed, with questions and answers. Resolutions were obtained from the St. Louis Medical Society stating smoke to be a contributory cause to illness. All these activities resulted in having the subject widely discussed.

The activities of the division resulted in a reduction in the density of smoke discharged from industrial, commercial, and semi-commercial plants, but this was not sufficient to show any marked improvement. The division reiterated time and time again that the then existing ordinance was not the solution to the problem—that a solution would not be had until there was an adequate amount of fuel available which was smokeless and which was sold at a price commensurate with its value.

"Tucker the Tinker"

In the fall of 1939 the city was visited with the worst smoke palls that had ever been experienced. Visibility was reduced to a matter of a few feet. One could not see across the main thoroughfares. Newspapers demanded the administration and the smoke commissioner do something, or resign. The commissioner, when he replied to the attacks, was designated as "The great epistolarian." He was called "Tucker the Tinker." Citizens who had formerly remained quiet proceeded to air their opinion upon the necessity of doing something. Various businessmen who had displayed only a cursory interest in the past, proceeded to express themselves forcibly. Pictures of our plight appeared in a national magazine. An article was written describing St. Louis as a "city of decay." Granted it was a little rough, and tough on the commissioner, but all this public furore created a situation which led to the ultimate solution of the smoke problem.

Citizens' Committee Formed

The names of all those expressing a desire for drastic action were listed in the mayor's office, and eventually a meeting was called inviting these citizens to discuss the smoke problem. At this meeting the mayor requested various of his department heads, as well as the smoke commissioner, to present a plan of action to the group. One department head recommended the distribution of smokeless fuel, subsidized by the city. Another recommended central heating plants. The commissioner recommended the use of mechanical fuel burning equipment and smokeless fuel. The mayor at this meeting stated to those assembled that it was his intention to appoint a committee of these citizens to investigate the smoke problem, and to abide by their recommendations. At the end of the meeting he appointed such a committee. It comprised James L. Ford, Jr., a banker; Kelton White, a stockbroker; Chas. Ulman, real estate operator; Dr. Alphonse McMahon, president of the St. Louis Medical Society; Gaston DuBois, director of research of one of the large chemical plants; John B. Sullivan, secretary to the mayor, and the smoke commissioner. The committee was called together December 11, 1939, and Mr. Ford was made chairman. It met daily—and many days all day—interviewing citizens, fuel dealers, coal operators, the owners of processing plants, and anyone else who desired to be heard. Too much credit cannot be given to this committee for the sincerity of its efforts. The members worked long, hard hours, and many of these men who knew nothing of the problem when they started, became well-informed before they finished. A report was presented by this committee to the mayor on February 24, 1940. It considered all the facts that had been suggested—central heating plants, use of natural gas, the building of municipal plants to make smokeless fuel, subsidized fuel, an educational program, and the use of mechanical fuel burning equipment and smokeless fuel.

Concurrently with the work of this citizens committee, a committee of the associated engineering societies of St. Louis was also considering ways and means for the elimination of smoke. Its report was filed at the same time as that of the citizens committee and was in agreement with it. The citizens committee report was based upon two cardinal principles:

1) That all those who desired to burn high volatile fuel must employ mechanical fuel burning equipment to burn it smokelessly.

2) If they do not desire to use mechanical fuel burning equipment, then they must use a smokeless fuel.

The committee further recommended that no one be exempted from the provisions of the ordinance. All were to be treated alike. The newspapers gave widespread publicity and approval to the report. These recommendations, with other pertinent recommendations, were incorporated in an ordinance amending the ordinance which was passed in 1937.

The provision for the railroads created a situation which gave the committee, as well as the division of smoke regulation, publicity

This picture, taken at 11 a.m. on April 16, 1941, looking west from the Civil Courts building in St. Louis, shows how the air was cleared

which they of their own volition could never have obtained. The date the ordinance came up for passage it was amended on the floor of the board of aldermen, exempting the railroads from the requirements. When it was passed and became known, the committee recommended to the mayor that he veto the bill if such an exemption were made. The mayor agreed to this mode of action. However, in order to avoid the necessity of vetoing the bill, he called the board of aldermen together and persuaded them to recall the bill for reconsideration and pass it as it had been originally submitted. This they did, and it became a law on April 8, 1940. The newspapers expressed themselves on this matter in no uncertain terms.

The passage of this law had many ramifications. It changed the buying habits of approximately 1,000,000 people. It changed the merchandising habits of practically all the fuel dealers in the city of St. Louis. It was necessary to move into the city, for hand firing furnaces, 1¼ million tons of coal having a volatile content of less than 23 per cent. Very little of this fuel, outside of coke and the processed Illinois coal, was available on the market. The sum total of these represented about 250,000 tons. So 1,000,000 tons of smokeless coal had to be moved into St. Louis. Dealers did not appear enthusiastic and seemed apathetic in attempts to obtain smokeless fuel. Efforts were started at the end of the heating season to persuade customers to fill their bins with Illinois coal because it was believed the commissioner would not make them take it out in the fall. When this became known, the commissioner ruled that on and after the first of May no fuel could be sold in the city of St. Louis for hand firing which contained more than 23 per cent volatile, and warned the purchasers of fuel in the event they bought fuel having volatile content in excess of 23 per cent that they would be required to remove it, and be liable to prosecution. It had been our previous intention to enforce this provision progressively. If we had, there was a grave possibility the citizens would have become dissatisfied. Instead, all provisions of the ordinance went into effect immediately.

USE THIS ARTICLE

and the others to follow on smoke elimination in St. Louis in your own community to inform city officials and your fellow-citizens on what can be done, and how it was done in this particular case. Abating smoke—of vital concern and advantage to all—is an engineering job.

The citizens committee became active and went to the sources of the supply. Eastern fields in the beginning were not interested, so a trip was made to Arkansas to investigate those coal fields. An ample supply was found there but the cost of mining was higher and the freight rate was practically equal to that of the eastern fields. The freight rate on Arkansas coal was $3.05, and on the eastern coal $3.37. The Frisco railroad, which runs through the territory, published a rate of $2.75. This was met by the Missouri Pacific. The Frisco then proceeded to initiate steps for a $2.00 freight rate in trainload lots. This program was finally carried up to the Interstate Commerce Commission, where this rate was allowed. This opened a new market for the Arkansas fields.

City Authorized to Contract for Smokeless Fuel

The citizens committee had recommended that a provision be put in the ordinance permitting the city to declare an emergency when and if there was not a free and easy flow of smokeless fuel at a price commensurate with its value. It also authorized the city to contract for the purchase of smokeless fuel for use and consumption in the city of St. Louis. The provisions of this section permitted this fuel to be distributed either through normal channels of trade or by the city itself. To support this, an appropriation of $300,000 was made for the purchase of such fuel. The establishment of a $2.00 freight rate, and the location of fuel in Arkansas, as well as the power of the city to engage in the fuel business if they so desired, stimulated the interest in the matter to such an extent that the million tons of fuel was provided for the city of St. Louis during the next heating season.

No doubt, as one reads the story of smoke elimination in St. Louis and sees the various ordinances that were passed, and the presumably arbitrary powers that were conferred on the commissioner, the question would arise as to the constitutionality of such a procedure. In the case of Ballentine vs. Thomas Hester, city marshal, city of St. Louis, the Supreme Court of Missouri, May term, 1942, ruled that the ordinance was constitutional. The interest in preserving the ordinance was such that the St. Louis Chamber of Commerce paid for the defense of the ordinance and joined in the case as an *amicus curiae* ["friend of the court"].

The same pattern of opposition was used as was outlined earlier in this article. Former Mayor Dickmann and Mr. Ford were accused of having interests in coal mines in Arkansas and stock in processing plants in Illinois. This accusation, like others, was groundless.

The result of this last smoke program is now known. It has reduced smoke in the city of St. Louis to a point where it is no longer a nuisance. Those deserving special credit for the success of this program are former Mayor Dickmann of St. Louis for the unqualified and unswerving support he gave to the division of smoke regulation, Jas. L. Ford, Jr., chairman of the smoke committee, for his indefatigable and sustained interest, and the St. Louis daily newspapers. There was a large number of citizens in St. Louis who willingly and cheerfully cooperated in the enforcement of the ordinance, and these too are deserving of credit. Then there was that small group who are rarely seen but without whom no success could have been attained—the personnel of the division of smoke regulation. It was this combination of citizens, press, administration, and competent employees that eliminated smoke from the city of St. Louis.

Air Freshening Liquid Introduced Into Ballroom Conditioning System

By H. E. Wheeler and Homer D. McCann
Air Comfort Corp

THE ARAGON BALLROOM, in Chicago, is air conditioned by a system installed in 1928. Not only was air conditioning for ballrooms new at that time, but air conditioning for any large public space was a fairly recent development; by modern standards, the air distribution could be definitely improved. However, there were two particular conditions that the owner, William Karzas, wished to better. One was due to the fact that on certain nights, particularly Saturdays, the number of dancers may run as high as 6000 or more, which is undoubtedly beyond the capacity that was anticipated by the designer of the air conditioning system. The other was that, while the people are fairly well spread out over the floor while the dancing is in progress, they congregate in very compact groups under the balconies between dances; as very little provision for ventilation had been made in these places, the condition was not ideal. The total amount of air circulated is approximately 50,000 cfm, and varying amounts of it are recirculated, depending upon the weather and the attendance.

"FRESHNESS" OF AIR is something of a mysterious quality, and there are a number of theories as to what really causes it. Mysterious or not, it's an important quality, and one that must be given consideration by the designer, owner, and operator of an air conditioning or ventilating system. . . . At the big Aragon ballroom, the problem came up in connection with an existing, 17 year old, air conditioning plant. It was met by installing five units which introduce fixed amounts of an air freshening liquid into the duct system. . . . justment of dampers, a fixed amount of air can be drawn over the liquid, impinging on its surface and causing agitation. At the same time, up to 300 watts of ordinary electric light bulbs can be used underneath the glass dish to speed evaporation by furnishing the necessary heat. Five of the units were installed at the Aragon, as shown in the accompanying photo.

How Liquid Is Introduced

It was decided to try to improve the condition by introducing a chlorophyll air freshener liquid. The unit for supplying fixed amounts of it into an air distribution system consists of a glass pan in which is inverted a 3 gal bottle, with an adjustable orifice so that an adjustable liquid level is maintained. All this is enclosed in a housing which is connected to the suction of the supply fan and to the return. By the ad-

One of the peculiarities of the liquid is that much greater quantities of it are required during the first month of its use than during any other time. It is thought that this is because there is an accumulation of odor-producing material in hangings, carpets, decorations,

The unit (below, at left) for introducing fixed amounts of the freshener liquid into the air stream consists essentially of a glass pan in which is inverted a 3 gal bottle. Ordinary electric light bulbs furnish heat to speed evaporation. Five units (right) were installed at the Aragon ballroom. Consumption of the liquid is running at about the rate of 15 gal. per month, for a usage of the ballroom six nights and one afternoon a week

ucts, and filters that must be neutralized before it seems to catch up with the job. In any case, the use on this job was nearly twice as much for the first month as for each subsequent month. At the present time, it is running at the rate of about 15 gal a month for a usage of six nights and one afternoon a week.

While it is next to impossible to get any objective measurement of the improvement in air quality, the management of the Aragon seems to be convinced that the quality of the air within the space has been definitely improved, and at reasonable cost. As more experience is gathered in the use of this adjunct to air conditioning, it may be possible to establish definitely the economy that would result from being able to circulate a larger amount of return air with equal air quality in the conditioned space. Since each 1000 cfm of outside air requires approximately 3 hp to bring it down to room conditions, the potential economy in conditioning large spaces is easily visualized. However, it has been the purpose of the management in this case to forego any attempt at economy in favor of trying to have conditions as nearly ideal as may be possible.

The entire subject of the quality of conditioned air could stand further investigation. There seems to be little agreement as to what really causes the quality of "freshness" in air. It is certainly admissible that, short of 100 per cent outside air, the quality of air in conditioned spaces is usually not as good as we would like to have it. The theory that the quality that our sense of smell recognizes as "fresh" is restored by contact with chlorophyll and sunshine is, at least, as tenable as any other theory that has been advanced to account for this mysterious quality of "freshness."

An interesting sidelight on this subject is revealed in research conducted at a leading university, which revealed that an odor intensity so faint as to be below the level of perception was nevertheless sufficient (if continued over a long time) to have harmful effects, causing lassitude, headache, loss of appetite, and similar symptoms. This opens up a large field for speculation on the subject of health, particularly as it applies to the efficiency of workers in business and industry.

"OUTSIDE FRESH AIR"

The editors of The New Yorker, our favorite weekly magazine, commented recently as follows on "one hundred per cent outside fresh air":

"You p r o b a b l y wouldn't know this, but the Stork Club is the only place in New York with a cooling system that makes use of 'one hundred per cent outside fresh air.' We received a notice to that effect yesterday, but the Stork Club can't lure us over there with bait like that. 'Outside fresh air' has a fine, clean sound till you get thinking about it; then you realize that the way to ventilate a room in Manhattan is never to allow the intake pipe to come in contact with the outside world but just let it pick up what little oxygen may be lying around the joint. Think what you get when you suck air in from the streets, where it has been used over and over again by teeming millions breathing in and out, in and out, in and out. Is that what the Stork Club calls 'fresh air'? Sometimes, on these fetid evenings, the air in the New York streets is so exhausted that a night-club proprietor might easily asphyxiate a whole roomful of people by introducing outside air in any considerable quantity."

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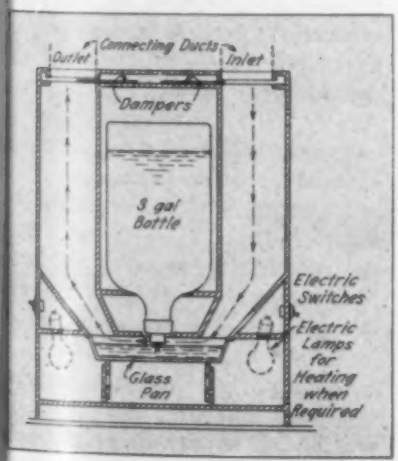
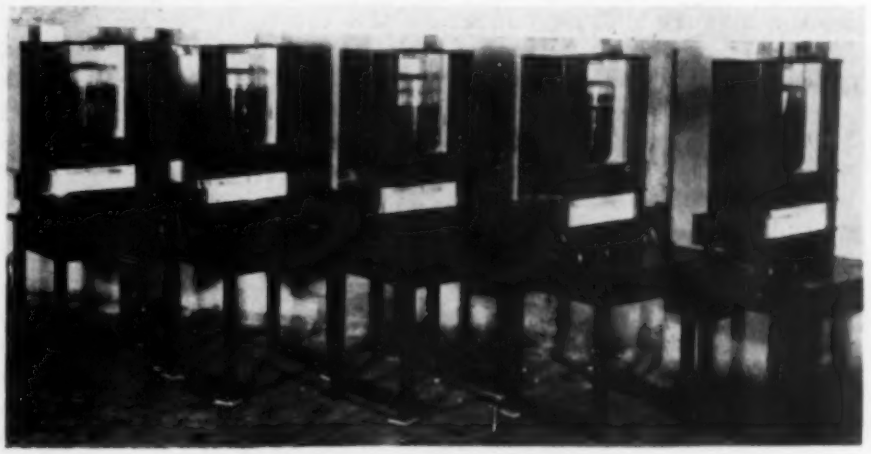




The Principles of the DRYING OF SOLIDS

By W. R. Marshall, Jr.
Engineering Dept.
E. I. duPont de Nemours & Co.

A WIDE VARIETY of modern industrial processes involve drying operations as highly essential steps—chemical manufacturing, leather production, textile manufacture, wood processing, pottery and ceramic manufacture, food preservation, and many others. Thus, a knowledge of drying principles is important to engineers and others concerned with the design, installation, operation, maintenance, repair, alteration, and extension of the heating, piping, and air conditioning services in industry. . . . The material presented here is based on lectures given by the author in a graduate course on the drying of solids, presented in the division of chemical engineering at the University of Delaware. Dr. A. P. Colburn is chairman of the division.

RELATIVELY FEW chemical manufacturing processes exist in which a drying operation of one kind or another is not involved. In the manufacture of pigments, colors, and dyes, the importance of the drying operation is reflected by the large investment in drying equipment, and by the high ratio of the drying cost to the total production cost. The successful manufacture of rayon and cellophane relies heavily on the drying operations which have important roles in imparting certain desired properties to the final product. Because of the importance of drying to the manufacture of rayon alone, hundreds of thousands of dollars have been spent by the chemical industry, equipment manufacturers, and government agencies on drying studies to understand and improve the drying mechanism. The manufacture of explosives involves drying operations which are highly specialized to this field, reflecting the hazards involved in the manufacturing process. The inorganic chemicals manufactured in processes involving precipitation or crystallization steps invariably require a drying operation. There are few chemical processes in which the materials pass through in a completely dry state. Many so-called "initially dry" solids may require drying, in some cases, as a result of moisture adsorbed from the atmosphere.

But the drying operation is not restricted to chemical processes. Such important fields as textile manufacture, leather production, wood processing, pottery and ceramic manufacture, and food preservation, for example, involve drying operations which are highly essential processing steps.

A comprehensive study of drying would include methods of drying gases, liquids, and solids. However, the equipment for, and the principles and treatment of the drying of gases and liquids are sufficiently different from those involved in drying solids that a study of the latter alone is entirely warranted and justified. It is the purpose here to present fundamentals and principles involved in the drying of solids only.

A study of drying can be approached from several viewpoints, depending on the problem at hand. From the standpoint of the designer of drying equipment, the mechanical problems involved in material handling and equipment design are more important than the mechanism by which a solid dries. On the other hand, the actual manner in which a solid dries is often of more importance to the individual responsible for the production of a product with definite quality specifications. In the drying of lumber, for example, the knowledge of the manner in which water flows through the cells of the wood is indispensable to the scientific operation of a lumber kiln. In the manufacture of clay products, it is only from a study of the internal mechanism of moisture flow that the factors affecting shrinkage and cracking during drying can be determined. Likewise, in the drying of foods, the drying characteristics of the material to be dried are of first importance, followed by the factors of dryer efficiency and dryer design. It can be concluded, therefore, that the dryer operator, the plant engineer and the process development engineer are concerned first with the drying characteristics of the product, and second, with dryer design, while the dryer manufacturer must be concerned primarily with the mechanical problems in the fabrication and operation of the drying equipment. Between these groups will be the consulting engineer, who must have a broad knowledge of both the design and operational phases of industrial drying operations.

In most chemical manufacturing processes involving a series of operations, it appears to be generally

true that the drying operation, if one occurs, is located at or near the end of the process; i.e., it is a *finishing operation:* It is also generally true that the operations prior and subsequent to drying show a marked similarity in nature in most processes. This is illustrated in Table 1, which indicates the nature of the operations before and after drying in several different manufacturing processes. It will be noted that in nearly all cases the treatment prior to drying is one of mechanical removal of moisture or liquid, while the subsequent treatment is predominantly one of crushing or grinding, packaging, or storing. It is misleading to consider the drying step in a manufacturing process as completely divorced from those operations leading directly to it and from it, and hence in considering commercial drying problems and the selection of dryers, the relationship to prior and subsequent operations should be clearly understood.

Drying vs. Mechanical Methods of Dewatering

In comparing drying with mechanical dewatering methods, it is important to point out that, whenever it is feasible, the removal of water by the latter method is the most economical, because in general the mechanical removal of a liquid from a solid can be performed more cheaply than removal by thermal means. This may be demonstrated by the following comparison between the costs of removing a given amount of free water from a crystalline material by centrifuging and by drying:

Assume that 100 lb (dry) of an inorganic salt is to have its moisture content reduced from 50 per cent, wet basis, to 0.5 per cent, and that a basket centrifuge will remove water down to 10 per cent. The power cost of mechanically removing the water to 10 per cent is approximately $0.05/100 lb of water removed, while for drying, the fuel and power cost is about $0.10/100 lb removed. If pressure filtration were used, the cost might be on the order of $0.04-0.06/100 lb of water removed.

It is apparent, therefore, that drying is generally required to remove liquid which cannot be removed by mechanical methods. Because in a large number of drying problems a mechanical separation method precedes the drying, it is important to be familiar with these various mechanical methods and their relation to the drying operation. Thus, it is generally desirable to use a continuous mechanical separation when the dryer is a continuous dryer, or vice versa. Likewise, it is important that the type of dryer selected be the best to handle whatever type of wet solid is discharged from the mechanical dewatering equipment.

Reasons for Drying

The purpose of drying, in many cases, is to remove a liquid from a solid material merely to facilitate handling in another operation. Or a liquid may require complete elimination from the solid before the product can be utilized at all, as in the case of pigments, rayon, sugar, etc. In other cases, drying is necessary to eliminate excessive shipping charges, because even though a product may eventually be used in a wet state, it is usually cheaper to remove water by thermal means than to ship it. This is indicated in Table 2, which compares shipping costs with approximate drying costs for three materials which may eventually be used in aqueous solution or with water added.

It is true that in some cases where a material is to be used in aqueous form, and only a short haul is involved between the point of proposed drying and the point of further processing, that complete drying might be found to be more expensive than shipping some water. The distance at which drying and shipping costs are roughly equal, for the materials in Table 2, is approximately 200 miles. Fig. 1 shows graphically the average relationship between drying and shipping costs for various lengths of haul.

In any drying problem, the physi-

Table 1—Operations prior and subsequent to drying in various manufacturing processes

Product	Prior Operation	Method of Drying	Subsequent Operation
Alumina	Thickening	Rotary dryer	Packaging
Casein	Pressing and grinding	Tunnel truck or rotary dryer	Grind or package unground
Coumarin	Filtering	Truck - tray dryer	Packing
Crystal alum	Continuous centrifuging	Rotary dryer	Screening
Iodine from oil brine	Crushing and washing	Truck - tray dryer	Packing in kegs
Lactose	Centrifuging	Rotary dryer	Pulverizing
Calcium lactate	Centrifuging	Pan dryer	Packaging
Basic magnesium carb.	Vac.-filter	Rotary dryer	Packing or storage
Silicon carbide	Filtering	Steam tube rotary dryer	Screening
Disodium phosphate	Filtering Centrifuging	Spray dryer Rotary dryer	Packaging and storage Screening
Vanillin	Filtering	Truck - tray dryer	Packing
Unburned refractories	Pressing	Air dryer	Kiln and ship
Dynamite	Mixing	Air drying in trays	Mixing
Ammonium phosphate	Blunging	Rotary drying	Product collection
Phosph. rock beneficiation	Drain and store	Direct fired dryer	Product collection
Super phosphate	Storage	Rotary dryer	Grinding
Glue and gelatin	Cooling and cutting	Tray dryer	Grinding
Leather	Jacking	Drying	Embossing
Lithopone	Filtering	Drying	Grinding
Titanium dioxide	Filtering	Through circulation drying	Pulverizing
Rayon	Washing	Tunnel drying	Coning
Soap (laundry)	Slabbing and cutting	Tunnel drying	Pressing and straining
Refined cane sugar	Centrifuging	Rotary drying	Screening
Dehydrated potatoes	Blanching	Tunnel drying or continuous through-circulation drying	Packaging
Powdered soap	Crutching	Spray drying	Conveying and packaging

cal state of the solid is the factor which determines the selection and design of the *type* of dryer best suited to the problem. Often, the nature of the material to be dried may demand the design of an entirely new type of dryer to meet special conditions caused by some special feature or features of the process as a whole. For this reason, drying equipment can rarely be completely standardized, and also, for this reason, many "homemade" designs are encountered in industrial plants.

Influence of the Physical State of the Solid on the Drying Operation

In general, it is possible to classify dryers on the basis of the physical form of the materials they can dry, although other classifications, such as the method of heat transfer, are equally plausible. The problem of classification of dryers will be considered in more detail in the discussion of dryer types.

There are two physical states of the wet material which will be encountered in drying solids—solid and liquid. However, it is possible for wet materials which are to be dried to possess every variation in physical form between the limits of a rigid solid and a thin liquid. Thus, we find in the drying of pigments, such as titanium dioxide, that a thick slurry or sludge will require handling and drying. In drying silica gel, however, an extremely friable, gel-like material is dried to a hard, crystalline mass accompanied by almost 80 per cent shrinkage. At the other extreme is the spray drying of anhydrous sodium sulfate from a water solution produced by heating Glauber's salt, $Na_2SO_4 . 10H_2O$, above its transition temperature of 32.32 C. In each case, different methods of handling and drying are involved.

The above remarks indicate how variable may be the physical nature of the material which can be encountered in any drying problem. These observations also suggest that the great difficulty in developing a general drying theory is due to the variety and complexity of structure of all the various types of solid materials.

Structure of Solid Materials

Unlike the gaseous and liquid states, a general theory of liquid-solid mixtures has not been developed nor received its proportionate share of attention. This fact does not seem strange, however, when one considers the extreme complexity of a study of just the solid state itself. If there is added to this a study of the effect of liquids on the properties of solids, it is apparent that the complexity of the study is greatly increased.

Only in the case of the structure of metals has a comprehensive study been made of solid structures, and even in this case the study has been of solid-solid mixtures and solid solutions. The results have not been found applicable to drying studies.

Some solid materials encountered in drying come from a type of process which gives the ultimate dry material a granular form, so that the wet material will have an ultimate particle characteristic to be considered as well as its macroscopic structure. Thus, for a given granular solid the manner in which liquid is retained in and between the particles, and the way in which it flows through the granular mass, will determine to a large extent the drying characteristics of the solid. Added to this will be the forces by which the discrete particles adsorb and retain the last traces of liquid after removal of the interstitial liquid.

In some cases, the solid may be in block or slab form, such as soap or lumber. In these instances, the idea of internal structure is easier to understand as well as to treat theoretically, because of the rigidity and definiteness of the shape of the material.

For solid materials which are spray dried from solutions or slurries, the concept of solid structure is not important until discrete, rigid particles are formed in the drying chamber.

In drying studies, it is sometimes possible to classify the structures of solids according to the manner in which liquids flow through them during drying. According to this system, the following mechanisms of liquid flow are considered to be important, although only one or two may control in a given solid:

1) Liquid diffusion in continuous, homogeneous solids.
2) Capillary flow in granular and porous solids.
3) Flow caused by shrinkage and pressure gradients.
4) Gravity flow.
5) Flow caused by a vaporization-condensation sequence.

In addition to liquid flow, the flow of vapors through solids is important in the final stages of drying, so that vapor flow by diffusion, by pressure difference, and by a vaporization - condensation phenomenon should be considered in any study of the internal mechanism of drying.

The mechanism of liquid flow in a solid undergoing drying may be determined by a study of the distribution of the liquid in the solid at various stages of drying. Thus, capillary flow will result in a distribution curve of a type which will be different from that for diffusional flow. It is sometimes possible to detect combinations of the two types of flow from liquid distribution data.

The technique of obtaining liquid distribution data is difficult, but the results generally furnish valuable insight into the mechanism of the internal liquid movement. Because of the experimental difficulties involved, only a small amount of liquid distribution data is available in the literature.

"External" and "Internal" Viewpoints of Drying

The preceding remarks concerning solid structure and the movement of liquids inside solids can be termed the "internal" viewpoint of drying, and it forms one basis for a development of a theory of dry-

Table 2—Shipping and drying costs compared

Material	Estimated average cost*, dollars, to remove 100 lb of water by drying	Cost of shipping 100 lb of water in the product 500 miles	1000 miles
Polyvinyl alcohol	0.30	0.46	0.68
Powdered soap	0.25	0.37	0.55
Ammonium sulfate	0.10	0.27	0.41

*Including only operating labor, fuel and power, and maintenance costs.

ing. Another approach, which is more frequently used, can be termed the "external" viewpoint; it involves a study of the effects on the solid of the drying conditions external to it; i.e., conditions which are independent of the internal structure of the solid. Thus, in air drying, it is customary to express the drying rate, for example, in terms of air velocity, air temperature, and some empirical coefficient to account for material properties. On the other hand, a drying rate based on the internal viewpoint would require for its expression the determination of the particular law or laws of flow which govern the internal liquid movement in the solid. This, in turn, would require certain data on properties of the solid, such as diffusivities for diffusional flow or capillary potentials for capillary flow, and possibly data on internal surface forces.

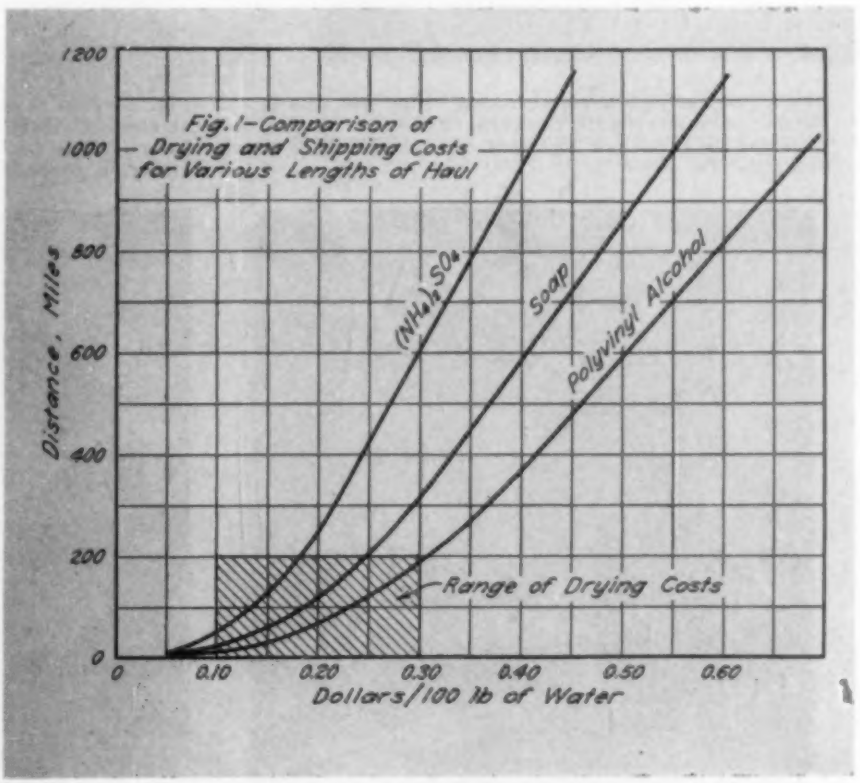
It has been found to be generally true that the external approach is both easier and more amenable to experimental study and design calculations than the internal viewpoint. The latter, however, has a more real place in fundamental theory and in the interpretation of dryer operation and performance, as will be shown subsequently.

Drying is the removal of a liquid from a substance by thermal means. The inclusion of "thermal means" in this definition serves to distinguish drying from mechanical dewatering methods such as filtration, centrifuging, decanting, or sedimentation in which no heat is used. However, the definition as stated does not differentiate among the operations of evaporation and distillation which also utilize thermal means to remove liquid from a material. As a result, it is necessary to base a distinction among drying, distillation, and evaporation on the type of equipment used for each operation. Thus, evaporation involves the use of evaporators which are quite unrelated to dryers both from the standpoint of design and operation. The same consideration serves to distinguish between drying and distillation.

The usual steps in the selection and design of a dryer are embodied in the following generalized example: Suppose you desire to dry a given solid from some specified initial moisture content to a specified final moisture content. The capacity desired is given as a certain number of pounds of dry product per hour, and, in general, the temperature limitation of the material is specified. The selection between continuous and batch operation may be required as part of the problem. On the basis of these preliminary data, the first step is to select the types and estimate the sizes of the various possible types of dryers required for the given capacity. Obviously, this is only a first step, although a very important one, since the decision as to the type of dryer to use is far reaching in all subsequent phases of the problem and in the process itself. After the possible types have been selected, one of these must finally be chosen on the basis of handling characteristics, cost comparisons, and possibly other special features. In general, experimental tests will be necessary to make the selection of the proper type.

After the decision as to the type of dryer has been made, it is then customary to present the problem of design to several manufacturers of the type of dryer selected for cost estimates, and finally to one manufacturer for final design and fabrication. In general, dryer manufacturers require considerable additional data for design, and so the secondary elements of the problem concern data on the services available in the plant, the nature of the source of heat, floor space available, construction of the floor on which the dryer will be located, available labor and cost, materials of construction, etc.

Probably the most important preliminary consideration in a drying problem is the method by which the wet material can be most satisfactorily handled. Once this has been established, the type of dryer will have been automatically determined. Very often the problem of handling the material satisfactorily is more difficult than drying it, and as a result the mechanical problems involved are the major ones. One notable example of this is the drying of glue and gelatin. These substances soften readily at temperatures of 110-120 F, and in order to dry them rapidly and continuously, several schemes have been developed in an attempt to dry at higher temperatures; i.e., methods of handling the material still in the soft condition without resorting to drying it in trays. Obviously, it is possible to hold any material in a tray and dry it, with no consideration being given to the time required for drying.



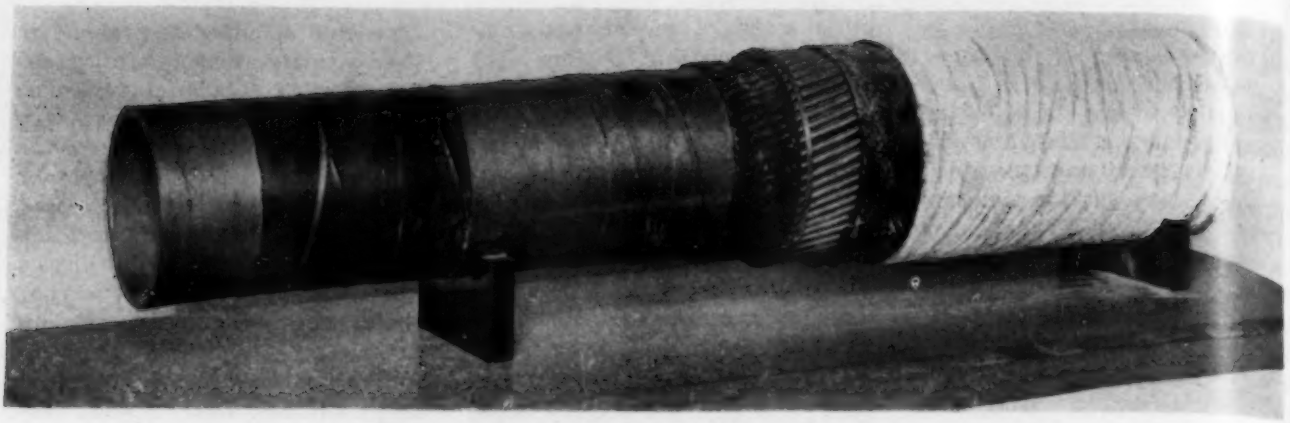


Fig. 1—Stepped sample of completed "HAIS" pipe

Manufacturing Cable Type Pipe for Submarine Service

AMERICAN PRODUCTIVE capacity and technical know-how aided the British government in achieving a modern engineering wonder, the laying of twenty 3 in. oil pipe lines under the English Channel to supply Allied armies with oil soon after they landed on the Normandy coast.

To American industrial plants which were given the momentous job of adding their great productive capacity to that of Britain, the project presented difficulties never before encountered. Average cables previously manufactured had an internal pressure of from 10 to 15 psi; the new line demanded pipes that could withstand pressures of 1200 psi.

Photos courtesy General Electric Co

Fig. 2—Lead pipe being extruded. Pipe was 3.05 in. inside diameter, wall thickness 0.190 in. Copper bearing lead with 2 per cent tin added. 2300 ft lengths

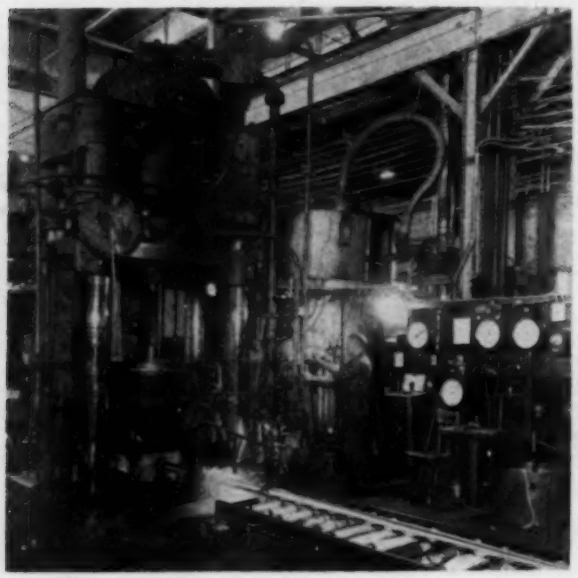


Fig. 3—2300 ft length of lead pipe and guide ramp at start of armoring operation. Note brake on reel flange. Pipe kept under 40 psi air pressure during armoring operations

Fig. 4—Wire armoring cages. Total of 57 galvanized steel wires 0.192 in. diameter. Two 24 bobbin cages and one special 9 bobbin cage. 250 lb bobbins.

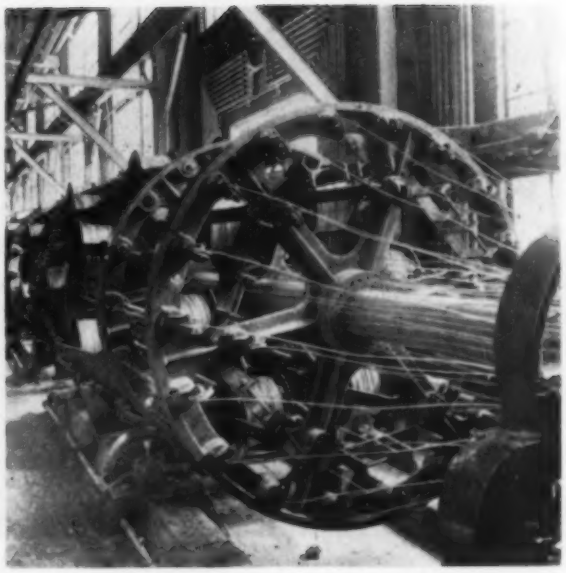


Fig. 5—Pipe being coated with asphalt and being wound on special steel reel, 108 in. diameter flange, traverse 92 in., drum diameter 77 in. Traversing type pickup stand being used

Fig. 6—Finished "HAIS" pipe cable going out through door, over power driven sheave, and into gondola cars for shipment. Control of power drive for sheave in right foreground. Overall diameter, 4.6 in.

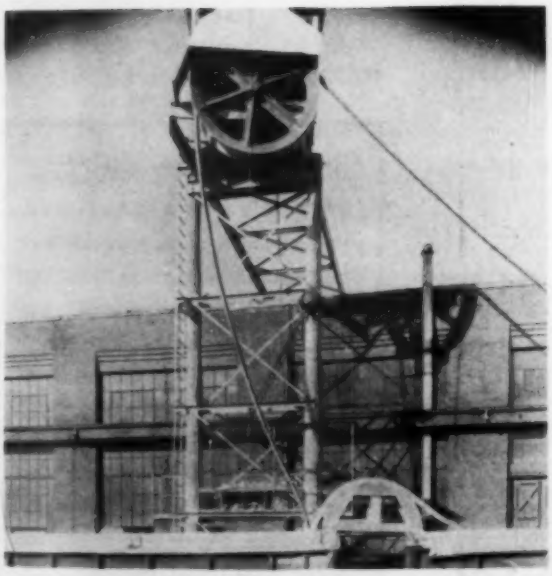


Fig. 7—Specially built tower structure with power driven grooved sheave (8 ft diameter) for loading pipe cable into gondola cars. Wooden form for shaping cable properly from car to car. Height of sheave shaft above ground was 40 ft

Fig. 8—Typical burst in finished pipe cable after 1 hr step test. Burst at 4125 lb per sq in. Note clean fracture of all four steel tapes

NDHA Reports Review the Year's District Heating Developments

Piping, Heating, Other Problems Are Discussed

THE 36TH ANNUAL meeting of the National District Heating Association, held this year at the Hotel Cleveland, Cleveland, Ohio, was unusual in that due to travel restrictions practically the only members in attendance were the officers, the members of the executive committee, and the chairmen of the technical committees. However, these committees had been at work during the year almost as usual and those present heard not only the reports of officers, but many worthwhile technical reports and papers. Several committees were unable to have their reports in final form for the meeting, necessitating a temporary delay in releasing an account of the papers.

A valuable part of any meeting is the discussion from the floor of the formal reports. Small attendance eliminated such wide discussion, but the NDHA is sending its membership the reports in pamphlet form to secure written comments, and when the bound volume of the proceedings is ready, the usual discussions will be found therein.

In his annual address, NDHA President Sterling S. Sanford, Detroit Edison Co., commented on the effect of the war on the association. He showed that in spite of conditions, NDHA had prospered and had increased in membership under the guidance of Membership Chairman Joseph M. Barnes, Philadelphia Electric Co. He expressed regret at the loss of three members by death—Lieutenant-Colonel Edgar J. Boschult in Germany; William J. Baldwin, Jr., an honorary member and past president of the association; and Charles Gordon Heydon, of Detroit. Resolutions on these deaths were passed later by the association.

A detailed report of the association finances was given by Secretary-Treasurer John F. Collins, Jr., of Pittsburgh. He said that the NDHA had been able consistently to help support the war effort financially by the purchase of war bonds. He pointed to an ever increasing demand on the headquarter's office to answer questions about the industry. A new activity on the part of the secretary, he said, was the visiting of member utilities. An index of the articles published in the past 10 years in the annual proceedings and quarterly bulletins will be published in this year's proceedings, he reported.

Automatic Control Gives 18.2 Per Cent Steam Saving

The commercial relations committee had two papers. Chairman George H. Tuttle, Detroit Edison, said that the first of these was on the conservation of steam by 80 typical customers of several member companies and that the results had been reported to the conservation division of the War Production Board. In 48 buildings, where the major step taken was the installation of automatic temperature control equipment, 68,900,000 lb of steam (or 18.2 per cent when corrected for temperature) had been saved in a 12 month period. In 10 buildings, where the principal change was the overhauling of the heating system, the reduction in annual steam use was 26,700,000 lb or 19.7 per cent. By the simple expedient of more careful operation without investment, 12 buildings showed a saving of 13,200,000 lb per year, or 11.1 per cent. The remaining 10 buildings were heated for less hours per day and thereby a saving of 14,600,000 lb of steam, or 8.0 per cent, was made. The average saving for the entire group was 15.7 per cent.

Mr. Tuttle said that his committee had investigated the items which are recorded by the steam utilities on their customer record cards, and it was found that 13 steam companies all show their customers' steam consumption for monthly billing periods, all use the degree day basis of comparison for space heating, and all calculate manually the pounds of steam used per degree day. One company uses a 70 F base for degree days instead of the usual 65 F.

Underground Steam Mains

Leonard S. Phillips, New York Steam Corp., reported for J. J. O'Brien of the same company, chairman of the NDHA distribution committee. The committee had prepared four papers, all relating to conduit and insulation enveloping steam mains.

The first paper, by Henry F. Davis, superintendent of engineering and construction of the Consolidated Gas Electric Light and Power Co. of Baltimore, described the re-insulation of underground steam

DUE TO WARTIME restrictions, this year's annual meeting of the National District Heating Association was confined in attendance to the officers, executive committee members, and technical committee chairmen. However, the committees had been at work as usual during the year, and many worthwhile technical reports and papers were given; the association is sending its membership these reports in pamphlet form to secure written discussion. . . . We review here the highlights of the reports; much of the material is pertinent to heating and piping in general, as well as to district heating in particular.

mains in that city with cell concrete. After running satisfactory tests to determine the extent of cell concrete bond to bare pipe, the effect on cell structure of rapid drying, and the crushing qualities of partially set up cell concrete, they re-insulated 1280 ft of old single pipe duct and 1360 ft of old multiple pipe duct by pouring 323 cu yd of cell concrete into it at pouring holes, thus avoiding excavating and removing the conduit top. As the men became more proficient, the man-hours per cu yd required dropped from 22.5 to as low as 12.4. The re-insulating job lowered the temperature of the adjacent ground as much as 50 F.

The paper by Walter A. Schulmeister, of the American District Steam Co., on the characteristics of cell concrete showed that by oven drying, cell concrete density was reduced from 18.08 lb to 15.80 lb per cu ft; that for a 24 in. x 24 in. x 1.98 in. thick specimen, the thermal conductivity in Btu per hr per sq ft per F temperature difference for 1 in. thickness with a mean temperature of 235 F was 0.58, with a mean temperature of 645 F was 0.92, and with a mean temperature of 989 F was 1.19; that a cell concrete specimen absorbed 6.92 lb of water per cu ft of the concrete, or 43.8 per cent by weight of the cell concrete in the oven dried condition; that nine hours in an oven at 212 F was required to dry completely saturated 2 in. cubes, and that the crushing strength of the material in a dry condition ranged from 56.5 to 65.0 psi.

Four types of pipe conduit, made of cement and sand, for insulated underground and outdoor steam piping were described in the paper by R. C. Parlett, of the Johns-Manville Corp. The paper indicated that this type of conduit has strength, resistance to soil corrosion, freedom from electrolysis, water tightness and lightness of weight (124 lb per cu ft). Conduit up to 30 in. inside diameter is in service. Pipe supports and pipe couplings also were described.

The manager of the Overbrook Steam Heat Co., of Philadelphia, P. M. Dolan, cited in a paper six cases to show that through no fault of the magnesia insulation, there is excessive external corrosion in

Coupling being installed on non-metallic pipe

steam mains covered with this product when encased in solid pour concrete conduit without an air space surrounding the pipe—especially on lines heated only during the heating season.

In his summary, Chairman O'Brien said the qualities of conduit needed are water-tightness, durability, strength, nondeterioration, and ease of handling.

Operating Statistics

The operating statistics committee—through its chairman, Thomas P. Brown, Jr., of New York Steam—reported that for the year 1944, although 82 per cent of the steam utilities responding said that they experienced warmer weather, 50 per cent said they had increased sales, probably due to greater occupancy and war activity. A majority of utilities reported an increase in both total and average revenue, a normal increase in connected load, an increase in the cost of fuels per million Btu except natural gas, an increase of 3 per cent in the number of persons employed and of 7.8 per cent in hourly wages, and a slight increase in total capital investment.

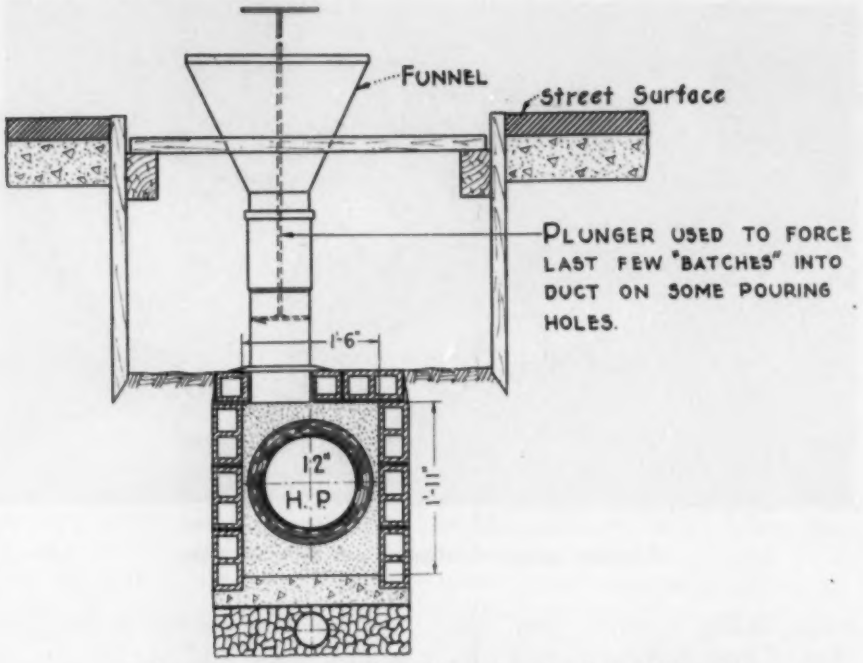
J. E. Seiter, member of the committee from Baltimore, in his analysis of the report said that the industry had had a slow growth up until 1943, when the war had resulted in a substantial boom. W. A. Herr, Philadelphia, commented that the system peak load is not always coincident with the annual minimum temperature—less than half the reporting companies had their annual peak load on the day of minimum temperature. J. C. Butler, Illinois Maintenance Co., Chicago, commented that a typical group of their customers had had a saving of 15.6 per cent in steam use in 1944. Such savings due to economy programs may have affected the comparative analysis for the past year or two.

Space Heating Steam Requirements

In his report as chairman of the research committee, A. R. Mumford, Combustion Engineering Co., reported on the space heating requirements of commercial buildings and hotels. He showed that the average annual steam use in seven commercial buildings in five cities varied between 0.00842 and 0.00667 lb per degree day per sq ft of exposed surface and averaged 0.00713, and in three hotels averaged 0.01120. Figures on process steam use were also given.

In introducing the papers included in the report of the rates and regulations committee, Chairman Harry A. Weitzman, Rochester Gas and Electric Corp., Rochester, N. Y., indicated the duties of his committee in general were to study and report on rate matters and on cost analyses, depreciation, tax matters, and other items affecting rates.

The paper by E. J. Steinberg, of the Wisconsin Electric Power Co., Milwaukee, entitled Independence or Interdependence of Steam and



Re-insulation of underground steam mains with cell concrete. Section of pipe duct showing pouring funnel

Electric Service, signified that some dependence between the services was recognized.

A report by a subcommittee, of which H. P. Smith of the Allegheny County Steam Heating Co., Pittsburgh, is chairman, showed progress on its assignment to develop an equitable form of rate embodying both capacity and commodity charges and applicable to steam services having relatively high load factors.

(To be concluded next month)

* *

RESTRICTS WATER USE FOR AIR CONDITIONING

The following bulletin was issued recently by the department of public utilities of the city of Richmond, Va.:

"In view of the fact that the demands for water now existing so much exceed the rated capacity of the Richmond city filter plant, and

"Because the amount of water used for air conditioning is at a maximum at the time when the use for other general purposes is also at a maximum, and

"Because it is generally known to the profession that the quantity of water required per unit of refrigeration can be enormously reduced by the use of economizers, and

"In view of the fact that the saving to the consumer in the amount he pays for water generally will pay for the relatively small added cost of economizers and in no way limit the effectiveness of the proper attainment of the cooling effect legitimately desired by the consumer,

"Under the authority granted by chapter 25, section 9 of the Richmon city code, I do hereby rule that, until further notice, this department cannot undertake to serve water for use in air conditioning equipment not already installed or bonafidely contracted for in a quantity in excess of five one-hundredths (0.05) of a gallon per minute per ton of refrigeration.

—J. E. METZGER,
Acting Director"

VELOCITY HEAD CONCEPT IN PRESSURE DROP CALCULATIONS

THE EDITOR—I have had the opportunity of reading the article by C. E. Lapple, Using the Velocity Head Concept in Pressure Drop Calculations (published in the April, May, and June issues) and borrowed the copy to apply to some of my own problems. I was greatly impressed by the simplicity of the calculations and the inherent speed with which flow problems could be solved.

I should like to have this paper in my personal file of engineering design data and should greatly appreciate it if you could supply me with a copy, including all necessary charts and tables.—C. D. SWAIM, technological dept., Shell Chemical Div. of Shell Union Oil Corp.

Peacetime uses of U-235 and plutonium must pass the dollar test in competition with coal, fuel oil, natural gas, gasoline and electricity, an article appearing in the September issues of McGraw-Hill publications emphasizes.

The article presents the following table to show at what price per pound uranium 235 could compete with common fuels if all other things were equal (but warns that "other things" never are equal and that many special costs and difficulties might prevent the competitive use of uranium 235 even at the indicated prices):

COMPARATIVE TABLE SHOWS AT WHAT PRICE PER POUND URANIUM 235 MIGHT COMPETE WITH COMMON FUELS—IF!

Common Fuel	Assumed Prices	Comparable Prices for Uranium 235, Dollars per Pound (Nearest Thousand)
Coal (13,000 Btu)	$ 6 per ton	$ 9,000
	$12 per ton	$18,000
	$15 per ton	$23,000
Fuel oil (150,000 Btu/gal)	2c per gal	$ 5,000
	4c per gal	$10,000
	8c per gal	$21,000
City gas (500 Btu)	50c per 1000 cu ft	$39,000
	$1 per 1000 cu ft	$78,000
Natural gas (1000 Btu)	25c per 1000 cu ft	$10,000
	50c per 1000 cu ft	$20,000
	$1 per 1000 cu ft	$39,000
Gasoline (150,000 Btu/gal)	10c per gal	$26,000
	20c per gal	$52,000
	30c per gal	$78,000

...on Operation, Maintenance, Repair, Alteration, Extension

Operating, Maintenance Ideas for the Refrigeration Plant

By George Holman, Operating Engineer

OPERATION AND maintenance of a refrigeration system of large or medium size (or, for that matter, of any mechanical equipment) demands attention to a number of details if best results are to be secured. Here are some more photos and comments to supplement those given on pages 436-440 last month:

Fig. 1—Pressure Gages as Indicators of Compressor Behavior: To diagnose any trouble occurring in the compressor or other part of the refrigeration system, the operating engineer must turn to the pressure gages. If the suction pressure does not fall as fast as it usually does when the compressor starts, the continued high suction pressure may mean that the suction stop valve is incompletely open, that a poppet type suction valve is sticking open or closed, that the discharge stop valve is sticking open, or that valve action is sluggish. Clogging of the equalizer port through which vapor enters and leaves the small cylinder of the dampener piston of the suction valve is one cause of sluggish compressor action.

Fig. 2—Vertical, Single Acting, Enclosed Crankcase Compressor: Important routine points of inspection and maintenance about a vertical compressor are:

Oil gage glasses. Inspected hourly, repacked yearly.
Outboard bearing. Inspected hourly, oiled weekly.
Packing and main bearings. Inspected hourly, rarely renewed.
Main bearing. Inspected hourly, rarely renewed.
Oil charged. Used weekly.
Oil filter. Cleaned monthly.
Cylinder walls. Felt hourly, viewed yearly.
Lubricator wicks. Viewed hourly, renewed monthly.
Scale trap. Cleaned monthly.
Cylinder heads. Removed yearly.
Safety valve. Tested yearly.
Oil pressure gage. Viewed hourly, tested yearly.
Suction stop valve. Packed yearly.
Bypass stop valve. Packed yearly.
Discharge stop valve. Packed yearly.
Pumpout stop valve. Packed yearly.
Shaft-end oil pump. Inspected yearly.

Fig. 3—Oil Filter: The oil filter may be cleaned by turning a small shaft, and the residue drained out of the filter well. However, the filter itself is generally removed once monthly for inspection.

Fig. 4—Suction Vapor Strainer: Scale, pieces of litharge, and other solid impurities blow along with the vapor in the return line and collect in the manifold strainer or

Fig. 1

Fig. 2

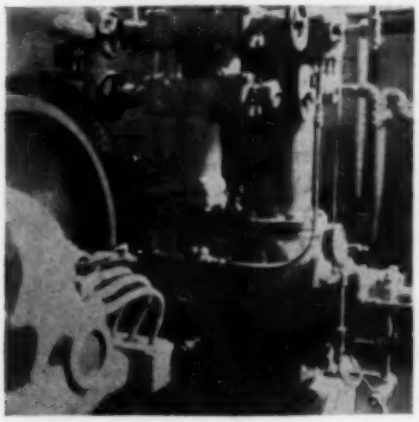
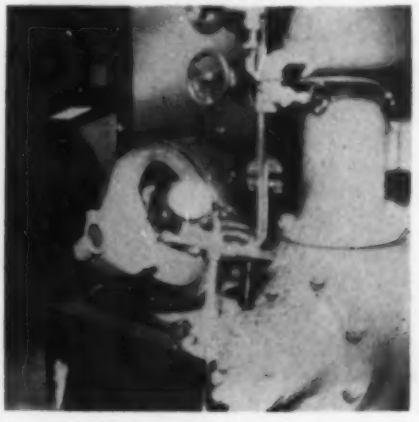


Fig. 3



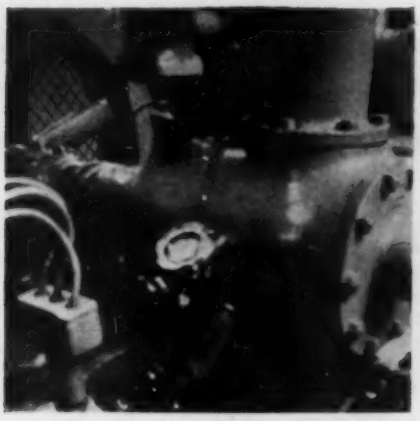


Fig. 4

Fig. 5

Fig. 6

Fig. 7

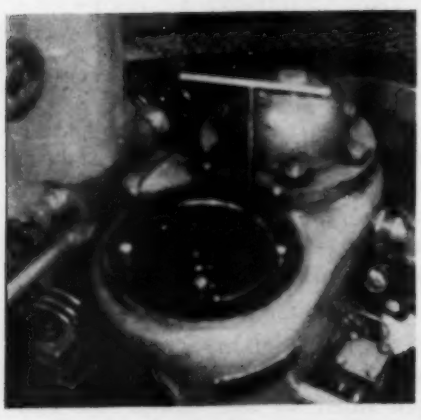


Fig. 8

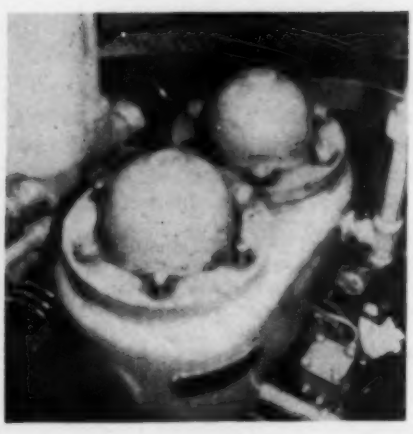


Fig. 9

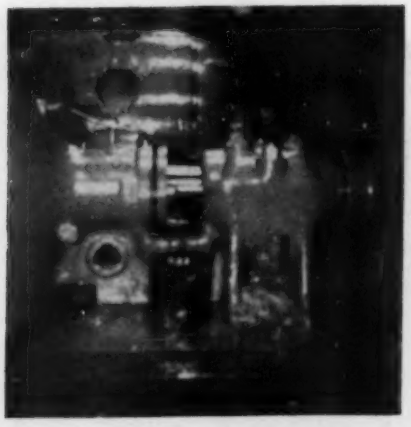


Fig. 10

Fig. 11

trap. Once each month this trap should be opened for cleaning and inspection.

Fig. 5—Wick-fed Lubricator: Since ammonia is highly caustic, cotton oil wicks of some types of lubricators gradually deteriorate. In this compressor these wicks are renewed once monthly.

Fig. 6—Repacking Compressor Discharge Stop Valve: Because of the heat and high pressure, discharge valves must be packed more frequently than stop valves in other positions. This can be done with the compressor operating. Valve is tightly backseated, and packing nut cautiously unscrewed. If there is no odor of ammonia, old packing can be dug out and replaced with new.

Fig. 7—Head and Compressor Machine Valves: The safety head should never be laid on its seating surface, unless cloth or paper is under it. Once yearly these machine parts should be given a thorough cleaning and overhauling. The suction valve cage, specifically the dampener piston and cylinder, contains the most precise moving parts of the compressor.

Fig. 8—Safety in Assembling a Compressor: A point to remember when assembling a compressor is to make sure that the screws holding the suction valve cage in the piston are all tight over lock washers.

Fig. 9—Replacing Heads Without Leakage: Whether gaskets are asbestos or of lead in an annular groove, they should be oiled before the heads or cover plates are put in place. Heads or plates should be brought down evenly, as shown here. In spite of the tension of the safety head spring, two nuts opposite to each other are here used to bring the head snugly to seat.

Fig. 10—Shaft Packing: Packing should not be taken up too much before renewing.

Fig. 11—Cutting Out Gaskets: Gaskets cut out by a ball peen hammer against the plate are used to hold water, brine, etc., but gaskets so cut usually will not hold ammonia under pressure.

Cleaning the Air Conditioning and Heating Equipment at the Stevens

By Harold M. Toombs, Chief Engineer
The Stevens Hotel

IN THE RECENT rehabilitation of the Stevens hotel, Chicago, cleaning the 15 miles of air ducts—and maintenance and repair of other items of the heating and air conditioning installations—were major tasks. The general duct cleaning problem, the method of cleaning the tile and brick air shaft, and the work done on the main air washer and on the heating surface were described in the August issue; this month, the story of the project is completed:

The fans that supply outdoor air to the public rooms rest upon the floor above, which forms the ceiling of the plenum chamber. All fans were found to be in good mechanical condition. The blading was perfect after 20 years of operation, the bearings true, and all the casings perfectly sound.

Each public room which is cooled is served by its own fan and spray chamber assembly. Cold water is supplied by a central refrigeration plant to each unit, and there sprayed directly into the air stream. The treatment accorded all systems was similar to that given the main air washer. It was interesting to note that wherever brass piping was installed in the water distribution system, it was neither scaled nor corroded.

The special cast iron headers submerged in the pan of the air washer had the internal area of the cross-section reduced as much as 75 per cent from scale. The headers were turbined with a regulation tube cleaner after a treatment of hot 50-50 acid-water solution. Special inspection was given the apertures in the spray nozzles, as well as the spacing of the sprays. An oversized orifice does not atomize the water and results in insufficient pressure to satisfy the requirements of the top sprays at the ends of the risers. This action results in the bypassing of large quantities of air, which never comes into contact with any cold water; consequently, the air is not chilled, pumping costs are high, and the washer gives generally unsatisfactory cooling.

Increased pumping capacity was obtained by enlarging headers and eliminating pipe fittings in order to straighten out the water circulating lines. More spray nozzles were added to increase spray chamber capacity. The entire interior surfaces of the washers were painted with special waterproofing. Interior lights and their switches were repaired.

The fans are powered by slow speed motors. It was discovered that small piles of dirt and dust had collected on the bottoms of the casings and along the edges of the scroll cases. If this dirt were blown away with a high pressure air hose, it would merely be dislodged and settle some other place along the system. Consequently access holes were cut through the casings with a torch, the casings vacuumed, and permanent handhole plates were cap screwed onto the casings, being pulled tight against a felt gasket.

THE PRINCIPAL aim of Chief Toombs in presenting this article is to give some practical suggestions on how to go about cleaning an extensive duct system, and other heating, ventilating, and air conditioning equipment, based on his recent experience when such a project was undertaken at the Stevens hotel. Many of his comments, however, are of just as much interest to designers as to operating and maintenance men. Much can be done in the original design and installation of a large air conditioning, ventilating, or heating system to simplify its operation and maintenance during the coming years, and increase the satisfaction with the results obtained. Plenty of access openings, for example, properly placed, mean a lot to the men in charge after the system has been in operation a few years or months

Beer Bottles, Lard Pails, a Hoe

Up to this stage of the cleaning program, a simple daily report served to record the progress of the work. Because of the complexity of the duct system, this method was now discarded. A schematic diagram showing all the ductwork of a single system was made in perspective, on cross-section paper. All elbows, dampers, splitters, and grilles were located, and supplies were shown in one color and exhausts in another. Progress was cross-hatched on the diagram and dated.

Air volumes of grille discharges were entered on the sheet. A trial calculation was made and actual field quantities were checked with an anemometer. This last procedure uncovered hidden dampers and, in two cases, sizable ducts that were completely blocked. One had been stopped with a feather pillow and another with a large bundle of newspapers. During the cleaning of the ducts a variety of articles were removed from them besides dirt—beer bottles, rats' nests, lard pails, and a hoe. The original design did not contemplate the cleaning of any ducts and as a result some 1000 access holes were cut into them, many of sufficient size to permit the entrance of a man. An electric driven, portable, hand saw served this purpose together with tinner's snips. A smooth job is

made by the saw, quickly and easily. Very hard, heated treated saw blades were used to stand the rigor of the work.

Men Worked in Pairs

The fan was shut down before the cleaning gang entered a duct. The men worked in pairs. Each was equipped with dust inhalator goggles, pocket tools, a putty knife, a large scraper like an ice scraper, and a whisk broom. Each party had a high pressure air hose and a flexible rubber vacuum hose with a flat nozzle, which was connected back to the house vacuum system. It would seem that an offering of a commercial set of tools for the specific purpose of cleaning air ducts should find a ready market.

All the ducts are rectangular. Cleaning proceeded from the fan. Where the cross-sectional area was reduced, one gang cut openings and fit cover plates, and was followed by the cleaning gang. Most of the dirt lodged in the horizontal runs. The bases of vertical elbows proved to be very popular spots for dirt accumulations. No rusting of any kind was encountered.

A man cleaned for 1 hr and was then spelled off by his partner. Risers were blown with high pressure air, first from the supply grille and then up from the supply side. All grilles were removed and both sides washed. Many are held in place by an ornamental plaster molding which had to be removed before the grille was taken down. The molding was not put back.

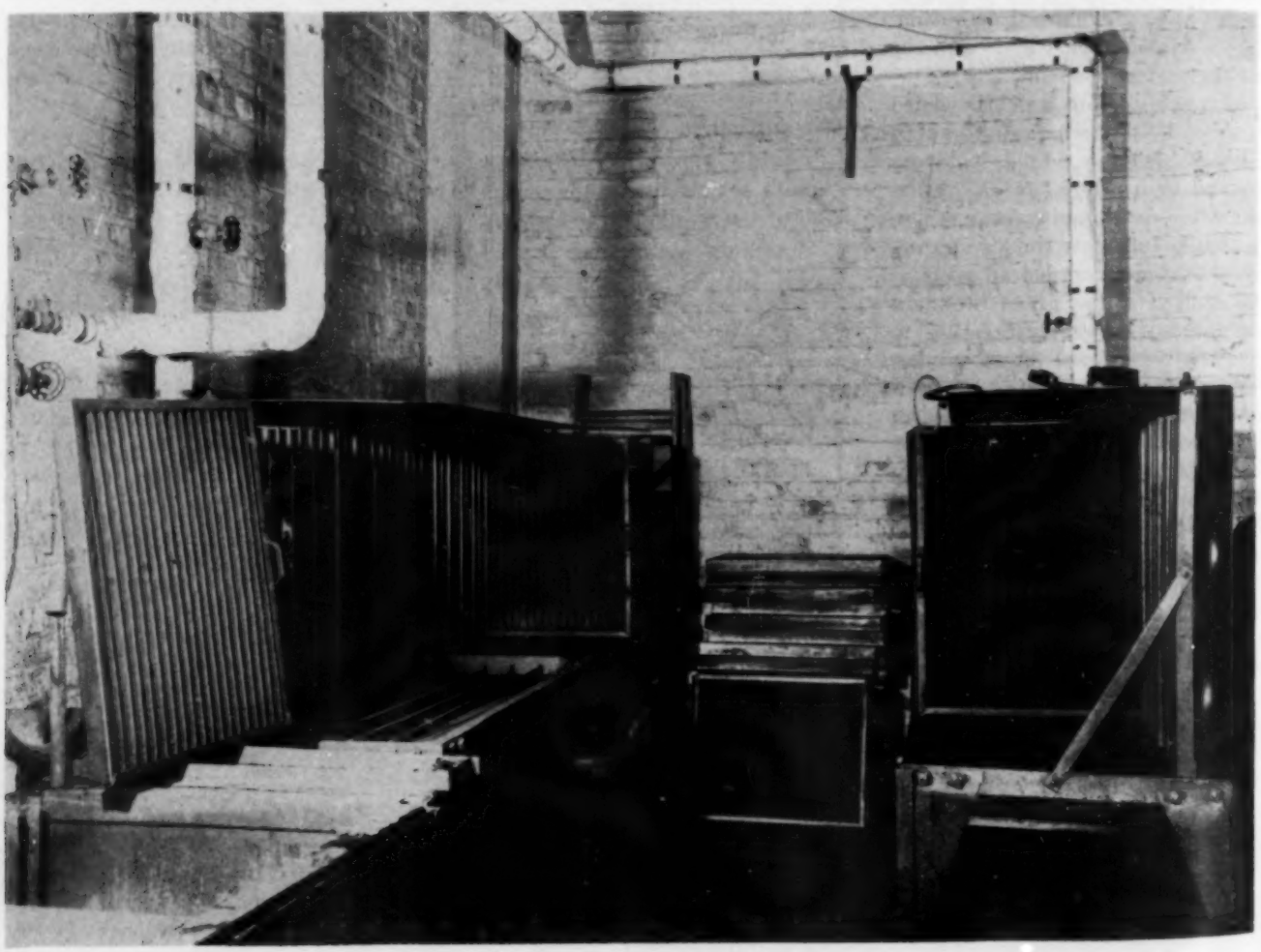
Ornamental grilles were not generally replaced. A directional type was selected, one that is shut by a lever. In the event that little air is needed, hostesses in charge of the room manipulate the damper—thereby satisfying the occupants. This was an educational problem at first, but has worked very well and saved many telephone complaints and much manual effort.

Increasing Air Supply

Where necessary that the air supply be increased, in some instances a particular system was cross-connected with one that had a low load factor. This increases the flexibility of control. Hard-to-heat rooms are supplemented with unit heaters placed in the supply ducts. Widely divergent room temperatures supplied from one spray chamber are easily controlled by this method, and it solved some extremely aggravating problems. Live steam was piped to the heater, controlled by a shutoff valve through a thermostat located beyond the heater. The fan runs constantly so that the normal air supply is not disturbed.

With the system cleaned, splitter dampers were set so as to give uniform room air distribution, grilles fitted, and the system put into operation. An overall average of 10 per cent increase in air volume was made.

In the routine maintenance of air filtering equipment at the Stevens, dirty units are regularly submerged in a detergent. Next they are rinsed with a hot water spray, then racked over steam coils for drying. After being sprayed by use of an air gun, they are allowed to drip for 24 hr in the right-hand rack shown in photo.



Other jobs tackled by the crew included the cleaning of grease ducts, elevator shafts (shown here), pipe shafts, removing dangerous fire hazards in the form of lint from the laundry discharge ducts, etc.

At the conclusion of the cleaning of one system, the cost was totaled and entered as a permanent record on the schematic diagram which summarized a complete history of the job. It had not been the intention to go into the duct cleaning business with the house maintenance crew on so grand a scale, but contractors shied away from the work because of its size. On some work night gangs were required, on others it was necessary to work overtime. The foreman checked the gang, made the schematic diagrams, and laid out the work. After being organized, it proceeded in an orderly fashion.

Cost Records Kept

Other jobs tackled by this same crew included the cleaning of grease ducts, elevator shafts, pipe shafts, removing dangerous fire hazards in the form of lint from the laundry discharge ventilating ducts, etc. Elevator shafts were painted after cleaning. The cost of cleaning small ducts averaged 30 cents per lineal foot and that of larger ducts scaled down to 10 cents. This price included all time and materials.

Dry filters on individual cooling units are removed every 30 days, washed, and sterilized in the equipment set up for the cleaning and which is scoured at three week intervals.

What This Experience Showed

As a result of this rehabilitation experience, I have come to the following conclusions:

1) There should be a good market for the sale of complete duct cleaning equipment.

2) Access cleaning doors are required in all systems and should be incorporated in the original installation.

3) A portable vacuum system and a small high pressure portable air compressor are necessary for the major cleaning operations.

4) Air supply grilles with external damper control are necessary for public rooms.

5) Annual cleaning and freshening up is required for each system.

6) The use of large plenum air supply chambers is better adapted for cleaning than are many smaller individual systems.

All dirt and dust in a room does not come in with the supplied air—a large percentage comes in on the feet and clothing of guests. Even the ordinary cigarette produces polluted air, while some cigars just plain stink. Body odors, floor abrasion dust, etc., plainly point to the fact that all recirculated air be filtered. I have traced the recirculation of smoke three times through a system before it became sufficiently diluted so that it could not be observed.

Why don't you contribute a "practical pointer" on operation, maintenance, repair, alteration, or extension of a heating, piping, or air conditioning system for publication in these pages? Regular publication rates are paid for them. Address The Editor, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.

Sam Lewis' Page

IT'S A BUSY LIFE!

HPAC'S EDITOR has asked me if the end of the war has meant less work or more work for consulting mechanical engineers. He also wanted to know—realizing the great variety of engineering work that was involved during the war—if postwar consulting has become more standardized or routine than were our activities before V-J Day.

I think consulting engineers in general are busier now than perhaps at any one time during the war—at least, it seems so to me! During the past several years, there has been built up a tremendous demand for a great many engineering projects, large and small, that necessarily had to be deferred until peace came. That's what we're busy with now. And as to the variety of postwar consulting engineering, I've summarized a few of the things we're busy with to answer his question further. I'm sure he'll agree that there *is* variety:

1) Removing and replacing a very heavy, large, and ancient steel chimney in a court entirely surrounded by skyscrapers. This involves special self supporting scaffolding, removing the old stack in sections commencing at the top, lowering these pieces through the stack itself about 25 stories, then carrying them around through one of the buildings to an elevator, lowering them to the basement, carrying them across the basement to another elevator, then raising them through the sidewalk. Having removed the junk, we must reverse the process and build the new stack via the same tortuous thoroughfares. The whole job also must be done without riveting or hammering to disturb the occupants of the hundreds of offices that open on the court.

2) Modernization of one of the earliest complete air conditioning installations. This thousand-ton plant has served many years with rather high velocity air delivery, rudimentary distribution, and inefficient dust removal. The refrigeration and the fan capacity need not be changed, but greatly increased illumination, low velocity air introduction, modern air filtration, and improved acoustics for thousands of office workers are being provided.

Restaurant Air Conditioning

3) Conversion of the complete air conditioning of a famous restaurant from using tunnel air (which has become unsatisfactory because of over-demand, increased haulage through the tunnel of debris, and curtailed circulation due to interference by new passenger subways).

4) Design of the refrigeration plant for a block-square hotel to deliver ice cubes frozen as such, by automatic machinery, to relieve the time-honored colored brother who saws great cakes of ice into cubes, shovels them into barrels or tubs, and wheels them around to the various bartenders.

5) A 400 psi steam boiler plant for generating electricity and pumping water, complete with mechanical coal and ash handling, feedwater purification, and complex piping systems.

6) Design of an electronic rectifier station for converting alternating electric energy to direct current for operating a number of existing heavy duty direct current presses and elevators. This scheme proves vastly superior to using motor-generators.

7) Heating a new hospital with radiant surfaces imbedded in the ceilings, these surfaces warmed with water. The principal rooms receive refrigerated and controlled air. There is a high temperature incinerator in the otherwise useless, hollow base of the chimney.

8) Heating hundreds of apartments in a 40 acre slum clearance undertaking, using mechanically circulated water. Laundries are in the airy top stories rather than in the usual dismal, smelly, basements.

Adventuring in Radiant Heating

9) Adventuring further and further into radiant heating with various new construction materials and methods of imbedding the surfaces in masonry. Using warm air as well as warm water, even keeping in mind the dog who so much desires a fairly cool floor on which to lie. Designing radiant heating to melt quickly the ice on the chassis of delivery trucks.

10) Rebuilding old, improperly designed vacuum steam heating plants so as to eliminate or minimize the disastrous sequelae of excess air and moisture in the presence of heat on the inside of a ferrous pipe, also to reduce damage to ferrous pipes from the outside due to contact with moisture that has previously leached through cinders and ash from bituminous coal.

11) Designing new heating and ventilating systems for school buildings, especially to replace old thermally-circulating warm air furnaces.

12) Reconverting steam boiler plants that once used oil, that were forced to change to coal, that now return to burn oil, more efficiently (I hope) than they did before.

Shooting Salesmen

13) Shooting high pressure salesmen for oil burners and coal stokers who seek to install mechanical combustion appliances in but one of two boilers in cases where both boilers should have the same equipment.

IN THIS regular feature, informal comment on heating, piping, and air conditioning problems is given by Samuel R. Lewis, consulting mechanical engineer, and a member of HPAC's board of consulting and contributing editors.

"Open for Discussion"

When Is Complete Air Conditioning of the Modern Factory Advisable?

"ONE OF THE FINEST ARTICLES"

THE EDITOR—In my opinion, the article by H. A. Mosher on the subject of When Is Complete Air Conditioning of the Modern Factory Advisable?, published in the June and July issues of HPAC, is one of the finest and most authenticated articles, with complete reference to the pertinent data, that has been presented as a convincing argument for the consideration of full air conditioning. His conclusion is definite that air conditioning should be considered with cooling means, rather than straight ventilation, to obtain the 75 per cent range of comfort in the factory.

Unfortunately, I am dictating this reply from Greenville, S. C., where I just had the misfortune of misplacing on a bus the article which I had clipped. The article definitely was appreciated by some stranger, and therefore I am quoting entirely from memory some of the figures on which I would like to comment.

I have had experience in using air conditioning in kitchens which, to my mind, is a "factory" proposition and which is proving more or less along the lines of Mr. Mosher's article: that the first cost is not much more than the cost of ordinary ventilation if you put in the half-minute or minute air change which is indicated for comfort in the kitchen. I have had the pleasure of doing several kitchens and instead of the ventilation air changes mentioned above, have effectively introduced cooled air of only one-sixth the volume and obtained much more effective comfort by the reduction of the moisture content, which of course you don't get with plain ventilation.

Mr. Mosher has not commented on the use of evaporative coolers for high heat concentrations, especially in low wet bulb climates, which of course is highly useful at a lower first cost than systems which would include a chilled water means. Evaporative cooling also is cheaper than the cost of ventilation on a comparable comfort basis, as you will handle in the neighborhood of 50 to 60 per cent of the air required for ventilation.

I want to comment on factories such as textile mills which have a concentration of heat load from 50 to over 100 Btu per hr per sq ft. This, of course, is way above the range of Mr. Mosher's table and means in effect that a considerable amount of air would be necessary to dissipate the heat, but of course air conditioning is indicated as the relative humidity of the air has to be maintained with close tolerances for the hygroscopic fibers being processed. Under very many of the textile mill processes, especially if air cleaning is required to a degree indicating the use of electrostatic filters, then the first cost using full air conditioning with a chilled water means is lower than for required ventilation with the humidifying means, and the operating cost with proper engineering usage is about equal to the cost of the ordinary humidifying and ventilating system producing the required humidities, or in some cases, it is even less in cost for operating. Naturally, by utilizing the cooling means, the effective temperature in the mills is lowered from 86 to 88 F to 78 to 80, with the resultant beneficial effect to the operating personnel.

It is interesting to note that in the war emergency the argument as presented by Mr. Mosher has been effectively used in many cases to prove to the War Production Board that less critical items were required if full air conditioning in many industrial processes was used rather than to insist on ordinary ventilation even if evaporative cooling was used, and certainly there could be no relationship or measure of the increased comfort as the ventilation system could not in any manner produce comfort to the operators, and thereby a low production efficiency was averted by the inclusion of full air conditioning.

I trust that these comments are of interest to you and we would like to have, for mailing to our clients and friends, 2000 reprints of Mr. Mosher's article.—A. C. BUENSOD, Buensod-Stacey, Inc.

AIR CONDITIONING'S A "WAY OF LIFE"

THE EDITOR—The article by H. A. Mosher, When Is Complete Air Conditioning of the Modern Factory Advisable?, in the June and July issues of HPAC, is timely and of value. Of course, from my standpoint there's no more argument about air conditioning in a factory or in a home or office than there is about heating. Can you imagine running an article in your magazine entitled, When Is Heating Advisable in the Modern Factory?

Air conditioning is a way of life, and while it's true you can get along without it, you can also get along without meat and sugar and cigarettes. But why bother? If, as, and when we can get air conditioning for the modern factory we expect that the idea will be taken for granted and articles of this kind stimulate thought in the right direction.—LESTER T. AVERY, president, Avery Engineering Co.

WHAT ASSUMPTIONS USED IN COST DATA?

THE EDITOR—The article on the comparison between ventilation and full air conditioning in the June 1945 issue of HPAC, written by H. A. Mosher, is certainly interesting and thought provoking. There can hardly be any difference of opinion on the value of air conditioning in the manufacturing process; the cost data presented, however, bring up several questions.

The figures for conduction and

sun effect are dependent on the construction of the building and consequently have a bearing on the overall cost of the factory, including necessary ventilation or air conditioning, but even more important variations result from the cost of power and the kind of cooling water available.

It would be interesting to know on what conditions the data presented in Fig. 1 and Table 2 of the article are based [page 306, June HPAC]. In particular the cooling water conditions have a great influence on both the initial cost and the operating costs of an air conditioning system, the most favorable conditions being when cooling water is available from deep wells, with an open water supply from river, lake, or sea next in line. The most unfavorable situation arises when cooling water is not available at all and has to be recirculated through cooling towers.

For full evaluation of the data presented in the article, we would like to know what conditions with respect to cooling water were the basis of the calculation.—P. PAUL KRIEK, chief engineer, American Enka Corp.

REPLY BY THE AUTHOR—In reply to the specific question in the last paragraph of the above letter, both capital and operating costs for air conditioning are based on condenser water being recirculated through a cooling tower. The capital costs for refrigeration equipment include approximately $22 per ton to cover the cost of the cooling tower and condenser water circulating system. Likewise, the operating cost for refrigeration includes the cost of air and water circulation through the cooling tower.

Regarding the question raised in the third paragraph in the above letter, the capital cost figures in Fig. 1 of my article are taken directly from Table 2, item 4, which in turn is derived directly from the data in the previous three items. In the interest of conciseness and brevity, however, the operating costs shown in item 5 were not supported by any great detail in the report. Since interest in this phase has been expressed, however, we have prepared an extract of the most pertinent sections from the calculations on which these operating costs were based. You will note that few actual computations are included, although all basic assumptions regarding occupancy and operating conditions are listed, together with a summary of the factors entering into the refrigeration cost, and finally a summary of total operating costs.

I hope this information will answer the questions satisfactorily, and appreciate the interest indicated.

Derivation of operating costs only for one floor of a general purpose building having 28,000 sq ft area, in Rochester, N. Y., as shown in Table 2, item 5, page 306, June 1945 HPAC:

The following are the assumed conditions of occupancy and operation—

1) The winter cost of heating the building shell can be made equal for either the ventilation or air conditioning system, and this cost will not be included in either total.

2) Cost of heating outside air in winter for ventilation systems can be made the same as that for air conditioning. Assume average outside temperatures, for six winter months, of 35 F DB and 30 F WB.

3) There will be a diversity factor of 60 per cent for internal loads, the space being occupied 10 hr per day, 5½ days per week. The average internal load will then be a fraction of the peak equal to $(10/24) \times (5.5/7) \times 0.60 = 0.197$.

4) Sunshine in Rochester averages 62 per cent of total daylight hours from May to October inclusive, or 1588 hr during the six summer months. The average insolation, properly weighted between morning and afternoon, is approximately 70 per cent of peak, so that the average load contribution from sun effect during the six summer months will be a fraction of the peak equal to $(1588/4375) \times 0.70 = 0.254$.

5) The average dry bulb temperature inside the space, with air conditioning, will be regulated at 78 F. This temperature will be exceeded outside approximately 530 hr during the six summer months, during which time the average outside temperature will be 85 F. Therefore the average conduction losses will be a fraction of the peak rate equal to $(530/4375) \times [(85-78)/(93-80)] = 0.065$.

6) The average inside wet bulb temperature will be regulated at 62 F. This will be exceeded by the outside wet bulb temperature for 1248 hr during the six summer months, during which time the average outside wet bulb temperature will be approximately 70 F. Therefore, with suitable bypass control, the average outdoor air

Average Rate of Refrigeration Use with Air Conditioning Systems

	Use Factors[a]	Btu per hr[b] $H_I = 10$	$H_I = 20$	$H_I = 30$[c]
Conduction	0.065	5,070	5,070	5,070
Sun effect	0.254	14,300	14,300	14,300
Internal load	0.197	55,200	110,300	165,600
Outdoor air	0.130	30,600	51,100	71,900
Totals, Btu/hr	....	105,170	180,770	256,870
Tons per day, average	....	8.77	15.05	21.4
Tons per year, 180 days	....	1,578	2,710	3,850
Yearly cost at $0.38/ton	....	$ 600	$1,030	$1,460

[a] See assumed conditions for derivation of these factors.
[b] Taken from Table 2, item 1, page 306, June HPAC, after application of the use factors.
[c] H_I is internal heat load in Btu per hr per sq ft of floor area.

Summary of Operating Costs

	Air Conditioning $H_I = 10$	$H_I = 20$	$H_I = 30$	Ventilating Systems $H_I = 10$	$H_I = 20$	$H_I = 30$
Heating outside air in winter	$ 370	$ 620	$ 870	$ 370	$ 620	$ 870
Electricity for air circulation	665	1,119	1,551	643	1,373	2,528
Refrigeration	600	1,030	1,460	....	....	....
Operating and maintenance (air systems only)	400	700	1,000	400	700	1,000
Totals per floor	$2,035	$3,469	$4,881	$1,413	$2,693	$4,398
Totals per M sq ft	$ 73	$ 124	$ 174	$ 51	$ 96	$ 157

cooling load will be a fraction of the peak equal to (1248/4375) × [(H_{70} — H_{w})/(H_{70} — $H_{w.b.}$)], where the H's represent total heats at the wet bulb temperatures shown by the subscripts. Substitution of appropriate values makes this factor equal to 0.13.

7) The total resistance pressure on the fans for air conditioning systems calculate to 2.5 in. WG; and 1.75 in. WG for the ventilation systems. Fan horsepower will be required at full volume for the former year 'round, but may be reduced to half volume (⅛ brake horsepower rate) for the ventilation system during six winter months.

8) Purchased power costs as follows:

(a) Electricity: $1.50/kw/mo demand. $0.007/kwhr for energy.
(b) Steam for turbine at 100 psi: $0.65/M lb average.
(c) Steam for heating at 5 psi: $0.50/M lb average.

9) Refrigeration costs as follows:

(a) Steam for turbine drive	$0.232/ton
(b) Electricity for tower fans	0.012
(c) Electricity for condenser and 35 F water pumps and miscellaneous apparatus	0.025
(d) Operation and maintenance (central refrigeration equipment only)	0.111
Total	$0.380/ton

The accompanying tables show use of the above data.

H. A. MOSHER, mechanical engineer, Kodak Park Works, Eastman Kodak Co.

COST "GUESSTIMATE" FOR AIR CONDITIONING

THE EDITOR—I have read with interest the article by H. A. Mosher entitled When Is Complete Air Conditioning of the Modern Factory Advisable? which appeared in the June HPAC. We have been making a study of air conditioning as it would apply to our textile mills where we spin and weave cotton for a light weight goods such as bandage cloth.

The conditions in the spinning room and weave room are particularly poor. The heat load in the spinning room, which has an area of 37,000 sq ft., is 89 Btu per hr per sq ft. Humidity is controlled at 50 per cent and temperature averages above 95 F for at least 40 days of the year. The conditions in the weave room are poor due to the high humidity which is controlled at 80 per cent and temperatures are above 85 F.

We have directed our attention to the improvement of conditions in the spinning room. Due to the necessity for humidity control we could not apply a simple ventilation system to our spinning room. In support of Mr. Mosher's article, we will quickly acknowledge the high cost of fans and ducts for a ventilation system to handle the necessary quantities of air to carry away the heat from a spinning room. With such high heat loads even the operating cost of the ventilating system would be higher than for a refrigeration system. We have been comparing a refrigeration system against an evaporative cooling system. A reliable contractor has given us cost figures for central station evaporative cooling systems and refrigeration systems. The cost of the evaporative cooling system, which includes two central stations and a duct system with pan outlets, is $27,000. This figure does not include the building changes necessary to accommodate the central stations or the wiring or piping to the central stations. We estimate that this complete installation would cost $40,000 to $45,000. If refrigeration is added to this system, the cost of the refrigeration equipment is quoted at $40,000 and the installation of the equipment would raise the total cost for the refrigeration system to $85,000 or $90,000.

On a per thousand square foot basis, the cost of the refrigeration system is $2,430. According to the figures in Mr. Mosher's article, this cost would only cover a heat load of 34 Btu per hr per sq ft, wherein our heat load is 89 Btu per hr per sq ft. It is because of the discrepancy in these figures that we are writing. Are Mr. Mosher's figures based on actual installations or are they also made on estimated costs? Is there anything about Mr. Mosher's system, such as concealed ducts or type of air outlets, which might increase the cost above that of a system such as has been quoted to us? The quotation for the refrigeration equipment for our system was based on centrifugal compressors.

We are also much interested in the economic justification for air conditioning. Because of the class of products which we manufacture, air conditioning will not materially improve the quality. The comfort of the workers is the only thing to be gained by the installation of air conditioning. During 24 hours, there are 150 people in the spinning room. When the combined costs of depreciation, maintenance, and operation are considered it costs over $100 per year per employee for the comfort of that employee.

Inasmuch as our figures do not agree with Mr. Mosher's figures, we would greatly appreciate his comments on our figures.

We wish to express our compliments for the high quality of Mr. Mosher's article in Heating, Piping, & Air Conditioning, which is at present a topic of conversation among air conditioning men.—J. N., development engineer, research div., Chicopee Mfg. Corp.

REPLY BY THE AUTHOR—Regarding the apparent discrepancies between our figures and the costs which "J. N." has shown, I cannot, of course, judge where the differences might arise without knowing more of the scope of work included in the costs quoted to him. In attempting to analyze his figures, I have prepared a "guesstimate" of the probable load in the spinning room:

Internal load: 89 x 37,000	3,293,000 Btu/hr
Conduction	150,000
Sun effect	100,000
Total	3,543,000 Btu/hr

Air volume required at a temperature difference of 20 F would be 163,000 cfm. It should be noted that this figure is close to the minimum volume which could be circulated to care for such large internal loading by means of either air conditioning or evaporative cooling, since the total load is not greatly

WHEN ENGINEERS gather to hear a paper or talk, there comes a time when the meeting is thrown "open for discussion." We follow this custom in these columns, which provide an opportunity for readers to comment on and discuss articles published in HPAC as well as other topics of interest to heating, piping, and air conditioning engineers and contractors. The editors will welcome your remarks. Address Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2

affected by the assumed values of conduction and sun effect. Also, I do not believe that temperature differences in excess of 20 F are generally accepted as good practice unless very unusual attention is paid to the method of air introduction and diffusion in the space.

On this basis, J. N.'s figure of $45,000 is at a rate of about $0.275 per cfm, which seems very low to me. The figure used in our report, or $0.90 per cfm for air conditioning, has been based on accumulated experience over several years on various types and sizes of projects, and would be broken down somewhat as follows:

Fans and drives	$0.10 per cfm
Filters	0.12
Washers, spray pumps, and piping	0.15
Ductwork, dampers, and diffusers	0.30
Heating and cooling coils, and steam and water piping and insulation	0.16
Engineering and drafting	0.07
Total	$0.90 per cfm

Perhaps J. N.'s system is very inextensive in duct layout, or need not include the best in filtering facilities, which would, of course, reduce the cost below that shown. It is difficult for us to visualize any system costing as low as $0.275 per cfm, however, and it seems likely that the figure is based on a lower air volume than is apparently necessary.

The figure for refrigeration equipment, too, seems low, since after due allowance for dehumidification of the outdoor air supply, J. N.'s peak refrigeration load should be in the neighborhood of 380 tons. His $40,000 cost would be at the rate of $106 per ton, which according to our figures would just about cover the cost of the bare centrifugal unit and its installation. The unit cost for refrigeration given in our report, or $195 per ton, would be made up about as follows:

Centrifugal compressors, evaporators, and refrigeration condenser installed	$108 per ton
Turbine drive, condenser, and auxiliaries installed	27
Cooling tower, condenser water pumps, and piping, installed	22
Chilled water pumping equipment and main distribution piping only, insulated	12
Control system and miscellaneous auxiliary equipment	10
Value of space	5
Engineering and drafting	11
Total	$195 per ton

If J. N. is interested in comparing both the above unit cost figures with other experience, he may be interested in Chapter IV of Carrier, Cherne and Grant's excellent book, Modern Air Conditioning, Heating and Ventilating [Pitman], keeping in mind that the costs shown therein are prior to 1940. Current overall costs would probably be about 25 per cent higher.

Regarding J. N.'s consideration of evaporative cooling, it is our belief that he will find it necessary to circulate much larger air volumes with that method than with air conditioning. For example, if the 163,000 cfm indicated for air conditioning is circulated when using evaporative cooling, the resulting condition in the space on an average summer day (74 F-62 F-54.5 F-50 per cent) would be about 82 F DB-68.8 F WB-62 F DP-50 per cent RH or about 75.5 F ET. At this condition only about 30 per cent of his workers would be comfortable. For half the summer hours more than this 30 per cent would be comfortable, but for the remaining half the time fewer and fewer would be comfortable, until on the worst summer days (93 F-79 F-73.5 F-54 per cent) no one would be comfortable, and the maximum permissible temperature of 88 F ET would be exceeded as resulting inside temperature would go to 101 F DB-84 F WB-79 F DP-50 per cent RH or 89 F ET.—H. A. MOSHER, mechanical engineer, Kodak Park Works, Eastman Kodak Co.

WE SHOULDN'T RESTRICT COAL FOR HEATING

THE EDITOR—We, as engineers subscribing to the code of ethics for our profession, ought to be ashamed of ourselves for our complete lack of social consciousness during this period before the impending coal shortage. We especially, the engineers for human health and comfort, should be most vociferous of all in condemning the limitation of coal for some domestic users to 80 per cent of normal requirements.

As long as we were actively engaged in a total war, the 80 per cent limitation was a patriotic obligation for the successful prosecution of the war. But now [August 26], two weeks after final victory, we are in the absurd position of having removed almost all wartime limitations except that on human health and comfort.

What justification existed after V-E Day to lift the dimout which was considered so vital for fuel conservation when no limitations were placed on coal consumption? After all, every kilowatt saved this summer would mean heat for somebody next winter.

Or what justification exists today for using precious coal to transport race horses, or to operate excursion trains, or to supply light when we revert to standard time? After all, every pound of coal saved will still supply heat to someone, some place next winter.

But even these complaints are not the worst that can be made on the coal limitation program. While very many coal users endure subnormal room temperatures in peacetime, users of gas and oil, both now unrestricted, will enjoy the peacetime health and comfort for which we all fought and worked. While these same coal users are cold, expanded and booming commerce and industry will be using record numbers of kilowatts and tons of coal.

It is my personal opinion that the logical place to limit coal consumption for the benefit of the domestic user is at the commercial and industrial channels. It is more reasonable to sacrifice a few million dollars of income for department stores, or a few thousand tons of steel production, than it is to endanger the health of millions of human beings. With this kind of a program, we could give more openheartedly the 6,000,000 tons of coal which Mr. Ickes says [page 422, August HPAC] will prevent anarchy in Europe. With this kind of program, the SFA would not have to terrorize the public in a "prepare for winter" campaign [page 61, front section, August HPAC]—a campaign in which we engineers have been so often derelict in our approach.

We have waged war for the dignity of the individual; let us not debase this dignity on the altar of the dollar sign. Nor let us not debase the dignity of our profession whose code of ethics requires the engineer "to interest himself in the public welfare in behalf of which he will be ready to apply his special knowledge, skill, and training for the use and benefit of mankind."—PHILIP BORKAT, chief engineer, Viking Air Conditioning Corp.

Radiant Heating Performance Studied in Field Laboratory

By F. W. Hutchinson

TO ASSIST in bridging the gap between idealized laboratory test procedures and uncontrolled actual test conditions, a radiantly heated "field laboratory" has been erected on the Purdue research housing campus. Four independent, grid type coil, copper tube, panel heating systems have been installed in this structure and complete instrumentation has been provided to permit use of precise experimental techniques for a laboratory study of an actual, full size, standard installation. From tests during the coming heating season, data will be obtained which are expected to assist in leading to more accurate evaluation of present design methods and to the determination, under field conditions, of the influence of such factors as ventilation rate and thermal capacity. . . . Mr. Hutchinson is professor of mechanical engineering at Purdue University, Lafayette, Indiana.

THE EFFECTIVE study of panel heating, like any other branch of engineering or of science, requires a threefold development from the initial theoretical paper work, through laboratory investigations under precisely controlled conditions, to the final verification (or qualification) by means of field tests on actual installations. Within the last few years it has become increasingly evident that the weakest link in our present knowledge of panel heating is that which should provide the transition from the second to the third part of the above program.

The first part, theory, has already reached a point such that an existing theoretical framework is available which will give accuracy equally as great as that of the empirical coefficients which must be used in its application. At least three theoretical procedures have been established within the last five years, any one of which would appear to be adequate for use as a basis of practical design. The work which yet remains to be accomplished in this first step is that of simplification of present complex and tedious procedures to some routine graphical or tabular form such that the practicing engineer can rapidly and accurately obtain the theoretical result. To do what is yet to be done is a task for the manufacturer (in preparing effective sales literature) rather than for a research organization.

The second part, laboratory studies under controlled conditions, has been under investigation at a number of universities as well as in the research laboratory of the American Society of Heating and Ventilating Engineers. From these studies data have been made available from which it is possible to predict with accuracy the influence of each of the many independent variables which enter into the problem; to estimate the performance characteristics of wall, floor, and ceiling installations; and to determine the basic distribution patterns which must exist in any radiantly heated room. Although much of the fundamental design work has been completed in this field, there remains a vast number of performance problems and of secondary design problems which have not been accorded laboratory treatment.

Studies of Installations

The third part, field studies of actual installations, has—of course—proceeded in parallel with the other two. Within the last few years interest in panel heating has greatly increased, and so also have the number of semi-technical or purely descriptive reports of American installations. Such reports are invaluable in that they provide information on maintenance, control, flexibility (or lack of it), seasonal costs, and architectural and aesthetic advantages (or disadvantages) which could never be obtained from either the paper studies of part one, or the idealized laboratory studies of part two. Unfortunately, however, studies of actual installations invariably fail to realize their potential effectiveness due to the fact that the variations

Prepared in cooperation with the housing research division of the Purdue Research Foundation: G. Stanley Meikle, research director of the foundation; Carl F. Boester, housing executive.

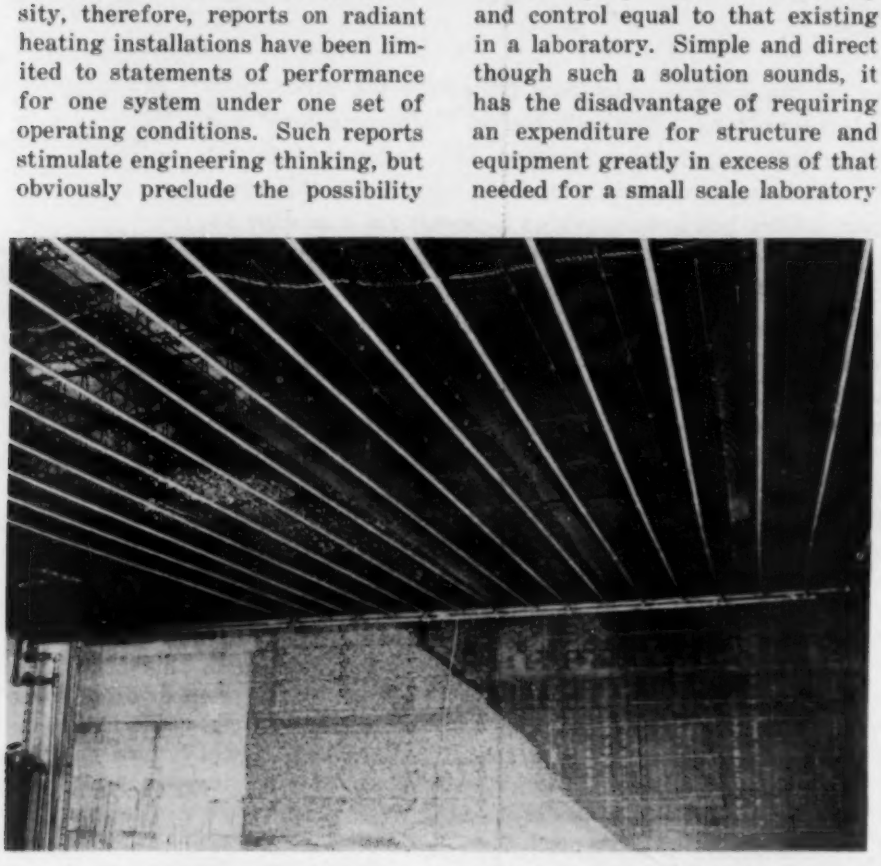
in design, in operation, or in control procedures which would be of interest and of assistance to the engineer cannot be made in the actual installation because the occupants can neither permit experimental changes in procedure nor afford experimental changes in design. Actual installations are intended to provide comfort and to do so with economy; hence, uncomfortable tests and expensive alterations cannot be allowed. Of necessity, therefore, reports on radiant heating installations have been limited to statements of performance for one system under one set of operating conditions. Such reports stimulate engineering thinking, but obviously preclude the possibility of ever obtaining answers to the inevitable questions which are raised as to what changes would have resulted *if* certain alterations had been made.

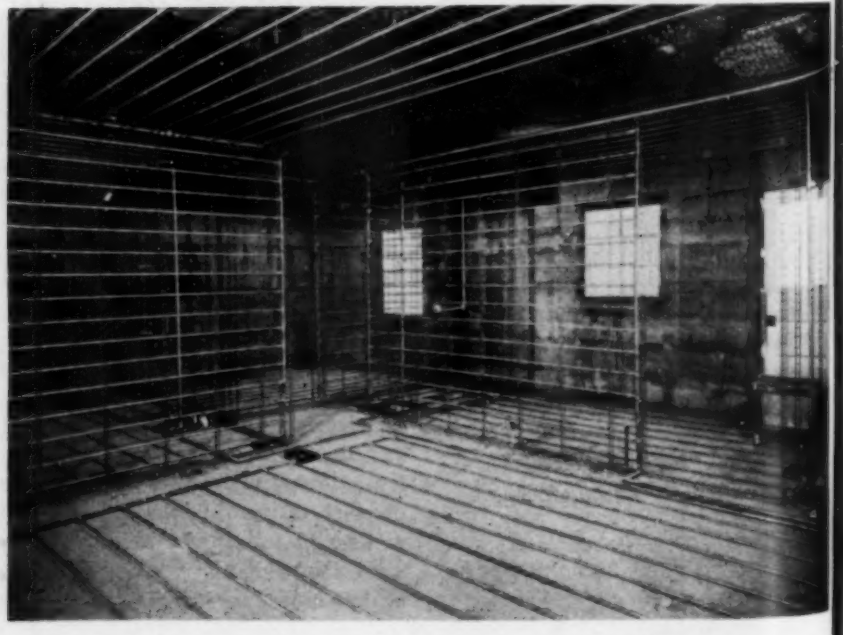
A "Field" Laboratory

The obvious solution to the problem of bridging the gap between laboratory and actual installations is to construct an actual system under conditions which permit its use for test purposes, with flexibility and control equal to that existing in a laboratory. Simple and direct though such a solution sounds, it has the disadvantage of requiring an expenditure for structure and equipment greatly in excess of that needed for a small scale laboratory study. In the present case the financial difficulty has been overcome through the cooperation and support of a number of interested groups; the result has been the erection and equipping of a "field laboratory" which is believed to combine many of the advantages of both an idealized laboratory test unit and a practical, full scale field installation.

Land and facilities for the laboratory were provided on the research housing campus of the Purdue Research Foundation. The structure is itself of interest in that it was constructed as an experimental unit in cooperation with an insulation research institute. In the photo of the ceiling, wet-packed vermiculite insulation is visible on the left side of the wall as seen through the expanded metal lath which is in place in preparation for the fixing of radiant heating copper wall coils and subsequent plastering. The center section of this same wall shows some dry-packed vermiculite behind the metal lath. Looking through the lath shown on the ceiling, the wire lumber framing is visible; loose vermiculite will be added as insulation above the ceiling lath as soon as plastering has been completed.

The copper coils which constitute the panel heating system were provided by a manufacturer of copper tube and fittings, and the other major elements of the heating plant were made available by a manufacturer of hot water systems and





Above—Ceiling coils enter alternately an upper and lower header; both are supply headers, so by adjustment of the flow circuits half of the ceiling tubing can be cut out of operation. . . . Right—The structure will be equipped with four separate and distinct panel heating systems—ceiling, floor, inside partitions, and outside walls. With these four systems, all installed in one structure, some interesting comparisons can be expected

specialties. The technical program has been developed by staff members of the Purdue school of mechanical engineering, and the research is being carried out in cooperation with the Purdue Research Foundation, with funds provided by the Copper and Brass Research Association.

As is evident from the photo of the room, a grid type coil of copper tubing has been installed in the ceiling below the expanded metal lath plaster base. On the interior walls and partitions, a grid type copper tube coil has been placed in between the non-loadbearing wire lumber studs. Expanded metal lath has been applied to one side of such studs. The interior walls will be plastered solid so that both sides of each wall will serve as heating surface. A separate grid type coil system is imbedded in the floor slab. The floor consists of 6 in. of vermiculite concrete laid directly on grade. The copper coil is imbedded in 1½ in. of concrete poured on top of the slab. The finished floor will be ⅛ in. wood parquet laid in mastic.

Four Separate Systems

At present, work is in progress on the installation of additional coils in the outside walls. Thus, the structure will be equipped with four separate and distinct panel heating systems; (1) ceiling; (2) floor; (3) inside partitions; and (4) outside walls. With these four systems, all installed in the one structure, some interesting comparisons can be expected. Further, the coils are installed in such a way that in some parts of the structure the effective coil surface can be either halved or doubled. Referring to the ceiling photo, for example, the ceiling coils are seen to enter alternately an upper and lower header; both are supply headers, so by adjustment of the flow circuits half of the ceiling tubing can be cut out of operation.

Flow meters have been provided for measurement of the hot water flow rates through the most important piping circuits, and two electronic potentiometers—together with heat meters and necessary auxiliary equipment—are available for determination of surface temperatures and rates of heat transfer. With respect to ventilation, the installation is believed to be unique in that the equivalent of normal infiltration can be obtained from a mechanical, positive pressure, ventilating unit which permits of accurate evaluation (as well as variation) of the number of air changes per hour. Since the ventilating rate is known from theory to be one of the most important performance - determining variables of a panel heating system, this innovation is expected to permit determination, for the first time, of accurate ventilation rate vs. air-temperature-depression curves for an actual, full scale system.

V-J Day does not alter the forthcoming National War Fund appeal, for the 19 member agencies which Americans are asked to support still have a big job facing them

Throughout the period of planning and equipping of the "field laboratory," every effort has been made to provide facilities sufficiently general to permit of effective use in carrying out any program of panel heating or cooling research which may later be desired. At present, however, the specific program which is being conducted in cooperation with the Copper and Brass Research Association has as its purpose the development of basic and fundamental data relating to certain aspects of the control and design problem which are of great practical importance, but which have received scant attention in the literature.

Specific Research Projects

Listed in the order of probable completion, the projects now under study are the following:

1) *The Influence of Temperature Variations Across Unheated Surfaces of a Panel Heated Room*

This study has as its purpose the investigation of nonuniform surface temperature both in its influence on the accuracy of theoretical design procedures and with respect to its effect on the comfort characteristics of a given room. Without exception, present design methods assume uniformity of temperature across each planar and homogeneous room surface. Thus, in the rational heat balance design-procedure, the inside surface temperature of all windows is assumed constant and uniform and the surface temperature of an unheated floor (in a room heated with ceiling or wall panels) is assumed uniform. Such assumptions are obviously incorrect, since the shape factor of the heating panel is a point function across window and floor areas, and hence necessarily leads to pronounced variation in the rate of irradiation of different sections of these surfaces. Whether or not the effect of interreflections and re-reflections among the various room surfaces has sufficient equalizing effect to reduce such variations to an insignificant minimum is a question which involves so many variables (as emissivities, shape factors, and film coefficients) that it can be more readily and accurately answered by laboratory - controlled field tests than by calculation. In the "field laboratory," calculated results for floor, wall, and ceiling systems will be checked and then extended in the hope of obtaining sufficient evidence to warrant generalized conclusions of value to the designer in estimating the error introduced through use of idealized uniform-temperature surfaces; if this error appears to be of practical importance, methods will then be investigated for attaining greater design accuracy through use of modified generalizations.

From the standpoint of comfort, nonuniform surface temperatures will be checked to determine an accurate mean radiant temperature (considering shape factors as point functions) for comparison with the MRT which is found from uniform-temperature finite - area calculations.

2) *The Influence of Ventilation Rate on Performance and on Relative Operating Economy*

The two major effects of ventila-

tion rate, evident from theoretical considerations, are that it is a direct function of the air temperature depression below the MRT and that it appears to be the most important factor in fixing the relative energy requirements of radiant and convective heating systems when considered for the same structure. By using the experimental setup already described, for varying the number of air changes per hour, data will be obtained which should permit of evaluating empirical correction factors for use with the rational performance equations. Placed in tabular or graphical form, the performance equations would then allow rapid determination of the potential operating saving, for any ventilation rate, possessed by a radiant over a convective system.

3) *The Influence of Thermal Capacity on the Performance of a Panel Heating System*

The four different and independent panel systems which are built into the "field laboratory" permit investigation of variation in thermal capacity on the "heat up" and "cool down" time and likewise permit attaining an accurate check on the ability of an installation having given thermal capacity to respond to outside temperature changes (or to changes in ventilation rate) rapidly enough to assure maintenance of comfort conditions within the room. The transient conditions back of the heated surface will be investigated, as will the influence of wide variation in flow rate, or water temperature, as a means of achieving rapid response.

Good Ventilation Important When Cleaning Machinery

RECONVERSION MEANS that much of the machinery stored for the duration needs cleaning before it can again be used, the Safety Research Institute, Inc., points out. Plants using organic solvents for this purpose, many of them handling these chemicals for the first time, should take special safety precautions against fire and illness.

Solvent vapors can be injurious to the health. Good ventilation is therefore essential wherever organic solvents are employed. Best procedure, says the SFI, is to use properly designed degreasing equipment or a mechanically ventilated spray booth. If a plant which has no such equipment must do a considerable amount of machinery cleaning, it may be advisable to install a special ventilator for handling the solvent vapors. This ventilator may consist of a motor driven blower which draws the contaminated air from the breathing level and also from the floor level, where the heavy vapor tends to collect. Small parts may be cleaned under a ventilated hood.

If the amount of cleaning is not very great, individual protection for the workers may be provided by means of gas masks. These should be of types approved by the Bureau of Mines for the specific conditions involved. Where the operator is provided with a mask, however, care should be taken that nearby workers are not exposed to solvent vapors, through lack of general ventilation. It may be desirable to carry out cleaning operations after regular working hours, so that only the protected operators are present.

In some cases natural ventilation, outdoors or in a well-aired room, may be sufficient for small, occasional, cleaning operations. This procedure may not always be safe, however, since weather conditions are variable.

Workers on or near cleaning operations should be instructed to report promptly to the foreman any strong solvent odor. Symptoms of illness, such as nausea, dizziness, headache, stomach or visual disturbances, should immediately be reported to the plant physician or nurse, who must be kept informed of the solvents in use. Some individuals may show unusual sensitivity to solvent vapors, and should be removed from the vicinity of the cleaning operation at once.

Skin troubles may be caused by frequent or prolonged contact with solvents. Where it is not possible to avoid skin contact with solvents, skin difficulties may be prevented by providing workers with protective clothing or creams and adequate washing facilities.

The chlorinated solvents, such as trichlorethylene, carbon tetrachloride, and perchlorethylene, are not fire hazards, according to the SFI, and may be used safely as long as proper ventilation is provided. The petroleum solvents, such as gasoline, benzine, and petroleum ether, on the other hand, are highly flammable, and require extra precautions. Specially designed ventilating equipment, nonsparking tools and shoes, and vaporproof lights must be provided. Strict observance of "no smoking" rules and suitable fire extinguishers, conveniently located, are important.

Certain solvent vapors may be corrosive, so that it is not advisable to keep fine machinery in the vicinity of cleaning operations unless there is an efficient ventilating system drawing off the vapors. Otherwise, the machinery should be covered, or the cleanup operation moved elsewhere.

DETROIT PLANS CONTROLS FOR WELL WATER USE

It is the belief of those in the department of health of the city of Detroit, who have made investigations of the circumstances surrounding an accident with a well water air conditioning system at a neighborhood movie theater when two men were killed, that the use of well waters containing considerable amounts of hydrogen sulphide and/or methane for air conditioning or quenching purposes should have very rigid regulations provided for such uses, says Dr. Bruce H. Douglas, health commissioner.

The various bureaus of the city are engaged in the effort to formulate some practical recommendations for controlling the drilling of such wells and the use of the water therefrom and, in addition, the provision for securing proper operation and maintenance of the equipment by periodical inspections of existing installations as well as any which may be installed in the future.

Heating, Piping & Air Conditioning

AMERICAN SOCIETY of HEATING and VENTILATING ENGINEERS

Journal Section

Sootfall Studies for New York City†

Part III of Air Pollution Survey Report

Jac Siegel,* New Orleans, La., and Benjamin Feiner,** New York, N. Y.

SUMMARY—This paper gives results of a survey conducted to obtain accurate measurements of the amounts of sootfall settling out over various parts of New York City. The sootfall can was used as the collection gage. The contents of the can were analyzed for soluble and unsoluble components. Results at 99 stations studied during each month in 1936 are presented on a geographic basis. The effect of wind movement and other meterological factors on the distribution of pollution is discussed.

THE MAJOR portion of atmospheric pollution in an industrial city such as New York results from the combustion of fuels. It consists of 2 fractions, the major part of which is made up of large particles which settle to the ground as *sootfall* after being in the air for only a relatively short period of time. The other fraction consists of small particles which remain suspended for a relatively longer period as *dust*. This paper deals with *sootfall* studies while suspended particulate matter is considered in another paper (1).[1]

No comprehensive survey of *sootfall* has been made in New York City prior to the survey reported here. Ives (2)[1] and his colleagues in their study of atmospheric pollution in 14 cities included New York in their investigation. However, in their study only one location was used, and observations were made during the winter months only.

In the survey herein reported, an average of 99 sampling stations was maintained during each month throughout 1936. These stations (Fig. 1) were carefully selected locations on the roofs of low, unobstructed buildings chosen so as to give adequate sample distribution on a geographic, population and industrial basis. As a result there were 29 stations in Manhattan, 11 in the Bronx, 18 in Brooklyn, 17 in Richmond, and 22 in Queens. In addition to these stations, control or comparison points were set up in Westchester County and on Long Island.

Apparatus, Collection of Samples and Method of Analysis

The sootfall gage used in this survey was a tin lined copper can, eight inches high and five inches in diameter (Fig. 2). This can was fastened to a wooden stand four feet high having a weighted base. This type of gage was selected because the collection in the can served as a fair criterion of the amount of matter falling on the roof and ground near the can and thus gave a direct indication of the extent of the pollution. During the course of this investigation it was found that results were reproducible to within 5 per cent.

All of the gages exposed were serviced close to the beginning of each month. This included the quantitative transfer of the contents of the can into a clean glass jar and then the placing of about three inches of distilled water in the empty can. (An anti-freeze solution was used in place of water during the winter months). The glass jars were then returned to the laboratory for chemical analysis.

In the laboratory, any extraneous matter including leaves, twigs, paper, etc., which might have fallen into the can and which could not be considered a constituent of atmospheric pollution was removed

†The third of a series of four abridged reports of the N. Y. C. Air Pollution Survey conducted by the New York City Department of Health, Ernest L. Stebbins, Commissioner, under the supervision of Sol Pincus, Deputy Commissioner and Sanitary Engineer.

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[1]Numerals in parentheses refer to Bibliography.

Fig. 1—Location of sootfall stations for 1936

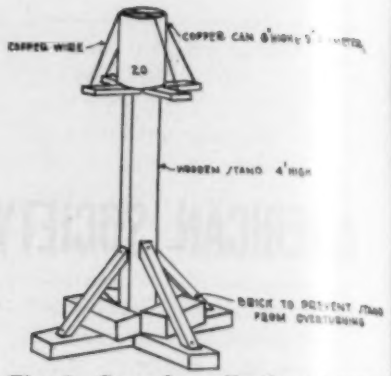

Fig. 2—Gage for collection of settled matter

by means of a 20-mesh sieve and discarded. The method of analysis then pursued was essentially as follows: The contents of each glass jar were filtered through a weighed alundum crucible to divide the sootfall sample into the insoluble and soluble fractions. The insoluble portion was further analyzed for ash, material lost on ignition (carbonaceous), and tar (carbon disulphide soluble material). The soluble fraction was analyzed for soluble solids, sulphates, chlorides, ammonia and ash.

Standard methods were used in the analyses of the various components. Chlorides were determined by the Volhard method; ammonia by steam distillation in a macro Kjeldahl apparatus into excess acid with subsequent back titration; and sulphates gravimetrically as barium sulphate.

In order to expedite the handling of so large a number of samples the following procedure was devised. After filtration of the sootfall sample through the alundum crucible, the crucible was dried and weighed to obtain a value for insoluble solids. This crucible was then placed in a Soxhlet extractor and the tarry material was extracted by means of carbon disulphide. After drying and weighing to get the value of tar by difference, this same crucible was placed in a muffle furnace at about 1400 F to remove combustible material in order to get the value for insoluble ash and, by subtraction, carbon. This method reduced the possibility of transferral errors.

Results

All of the results obtained by the above analyses were converted to *tons per square mile for a 30-day period*, and all the data of this survey are reported in these terms. The value for total solids was calculated by adding together the values for insoluble and soluble solids.

Table 1 is a 1936 summary of the total solids settling out each month in the various health districts of New York. The highest degree of pollution was found in two Health Districts: The Lower East Side and the Kips Bay areas. The intensity of this pollution as compared with the remainder of the city is shown in Fig. 3. As was to be expected it was found that of the boroughs, Manhattan had the highest pollution. It is the most concentrated and the most active area (commercially, industrially, and by population), of all the boroughs.

Stern (3), in the preceding part of this report, showed the close correlation existing between the intensity of fuel consumption and the resulting soot-fall in the various areas of the city.

The mean monthly deposit for New York City as a whole was 55 tons per square mile. This compares favorably with the extent of pollution found in other industrial cities (Table 2), for which data were available and agrees with the results reported by Ives (1) in which New York was placed in the middle pollution group of the three groups of cities investigated.

Comparative total solids figures for the 5 boroughs and the control stations are presented in Table 3. As can be seen, the ratios of the boroughs to control stations vary within a close range for the months of April to November (Manhattan, 2.1 to 6.9; Bronx, 1.2 to 3.7; Brooklyn, 0.9 to 3.7; Queens, 0.9 to 2.9; Richmond, 0.8 to 2.3). For the month of December, however, the ratio suddenly increased to about 3 times that for the rest of the year. The explanation of this seems to be that since there was an un-

Table 1—Sootfall (Total Solids) in Tons per Square Mile per Month—1936*

District	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Central Park	...	65	71	67	55	41	49	87	54	61	50	72
Washington Heights	64	55	61	48	71	74	42	51	64	73	76	101
Central Harlem	71	...	106	79	81	63	63	52	55	61	40	104
East Harlem	...	111	72	97	70	48	68	48	90	108	42	128
Kips Bay	241	240	223	202	181	115	93	100	75	173	151	184
Lower East Side	215	330	231	146	210	122	134	94	137	151	127	216
Lower West Side	155	169	182	121	84	80	61	72	63	177	76	206
Riverside	140	55	224	136	68	65	52	64	58	102	68	143
MANHATTAN	149	153	157	115	104	81	69	71	73	127	84	158
Fordham	31	...	29	109	19	40	49	30	29	35	36	56
Pelham Bay	61	22	66	75	48	42	47	41	52	40	40	91
Tremont	...	56	105	50	54	58	38	43	45	70	53	85
Morrisania	...	...	50	42	58	42	27	44	49	37	28	75
Mott Haven	109	62	206	88	113	76	47	75	80	110	69	108
Williamsbridge	69	...	40	68	67	49	45	37	55	83	34	71
BRONX	62	37	68	77	56	48	45	42	50	60	41	78
Williamsburg	150	100	119	89	88	99	49	81	74	112	92	140
Red Hook	65	76	79	89	70	94	19	50	46	107	57	116
Ft. Greene	210	...	159	136	103	142	100	111	116	137	113	150
Bedford	...	...	43	50	55	67	37	38	39	51	38	75
Bushwick	128	103	85	62	79	62	52	73	79	77	51	106
Sunset Park	...	85	42	26	38	44	19	51	55	48	45	71
Flatbush	39	36	46	52	48	42	19	60	49	70	41	131
Brownsville	72	44	13	60	24	49	23	48	45	34	35	73
Bay Ridge	...	...	...	66	71	48	20	60	42	20	27	74
Lower Flatbush	60	...	36	50	48	56	26	32	46	34	51	59
BROOKLYN	80	60	56	62	55	60	30	57	54	61	49	99
Astoria	115	161	107	110	99	52	51	54	121	56	46	131
Corona	50	33	14	52	51	46	35	47	43	51	42	52
Flushing	29	26	45	37	34	31	29	36	47	39	25	30
Maspeth	79	...	56	35	33	33	24	39	28	34	38	56
Jamaica West	54	...	90	31	37	44	24	45	33	34	39	76
Jamaica East	45	...	49	74	45	68	32	36	39	34	42	71
QUEENS	53	44	60	50	44	44	30	41	46	39	36	61
St. George	83	40	37	43	38	38	30	50	48	40	34	64
Tottenville	51	32	34	32	30	38	23	43	42	48	40	53
RICHMOND	67	36	36	38	34	38	27	47	45	44	37	59
NEW YORK CITY	70	53	62	59	50	50	34	48	50	55	44	79

*Note—The averages are weighted.

Table 2—Average Total Solids for New York and Other Cities

City	Area Covered	Year	Season	Total Solids Tons/Sq. Mi./Month
Manhattan, N.Y.C.	One borough	1936	Whole year	108
Bronx, N.Y.C.	One borough	1936	Whole year	53
Brooklyn, N.Y.C.	One borough	1936	Whole year	57
Queens, N.Y.C.	One borough	1936	Whole year	44
Richmond, N.Y.C.	One borough	1936	Whole year	42
New York City	Citywide	1936	Whole year	55
Salt Lake City, Utah	Citywide	1919-20	Sept.-April	29
Philadelphia, Pa.	Citywide	1934	Feb.-March	41
Cleveland, Ohio	Citywide	1927-29	Whole year	65
Chicago, Ill.	Citywide	1935-36	April-March	69
Chicago, Ill.	Citywide	1936	April-June	81
Pittsburgh, Pa.	Citywide	1929	Whole year	170
Baltimore, Md.	Center of city	1928-29	Whole year	150
St. Louis, Mo.		1929		190
Grafton, W. Va.	Citywide	1922	Whole year	156
Washington, D. C.	7 & B St., S.W.	1932-33	Whole year	25
Detroit, Mich.		1927	Whole year	99

Table 3—Total Solids for New York City and Boroughs Compared with Control Stations April-December 1936

Month	Average Total Solids for Control Station	Ratio of Boroughs to Controls: Manhattan	Bronx	Brooklyn	Queens	Richmond	N.Y.C.
April	26	4.4	2.0	2.4	1.9	1.5	2.3
May	15	6.9	3.7	3.7	2.9	2.3	3.3
June	23	3.5	2.1	2.6	1.9	1.7	2.2
July	32	2.2	1.4	0.9	0.9	0.8	1.1
August	34	2.1	1.2	1.7	1.2	1.4	1.4
September	25	2.9	2.0	2.2	1.8	1.8	2.0
October	28	4.5	2.1	2.2	1.4	1.6	2.0
November	19	4.4	2.2	2.6	1.9	1.9	2.3
December	11	14.4	7.1	9.0	5.5	5.4	7.2
Average 9 mos. of 1936	24	5.0	2.8	3.0	2.3	2.0	2.6
Monthly maximum	34	14.4	7.1	9.0	5.5	5.4	7.2
Monthly minimum	11	2.1	1.2	0.9	0.9	0.8	1.1

usually high precipitation during December (over 7 in.), the solid pollution produced in New York City was brought down very close to its source. As a result there was very little pollution left in the atmosphere to be carried to the outlying areas, represented by the control stations in Long Island. In other words, there was less dilution and scattering of the pollution, and more concentration at its source. This seems to substantiate the claim that rain serves to clear the air of particles which fall into the *settled matter* classification. Additional experimental evidence of the effect of rainfall on settled matter will be discussed in greater detail later in this paper.

Components of the Settled Matter Pollution

As has been mentioned previously, the settled matter collected in the sootfall can was analyzed for its various insoluble and soluble components. The term *tar* as used in this survey includes all of the organic compounds in the water insoluble fraction which are soluble in carbon disulfide. These tarry compounds are part of the carbonaceous matter, but they have been reported separately because of the important role they play in atmospheric pollution. The *undetermined components* are calculated fractions of the soluble solids and include compounds which have not been identified by chemical analysis.

The values obtained during 1936 for these various components are reported on a health district basis in Table 4. These data show not only when and where the sootfall settles, but also the nature and, to some extent, the origin of the pollution.

Insoluble Solids: The geographic distribution of the *insoluble solids* component was very similar to that obtained for total solids. The more polluted Health Districts were Lower East Side and Kips Bay in Manhattan, and Fort Greene in Brooklyn, followed by Lower West Side in Manhattan, and the Mott Haven district in the Bronx. The close correlation between total settled matter and insoluble solids was further substantiated by a comparison of all the individual insoluble solids values during May with those obtained for total solids. A

straight line relationship was obtained when one was plotted against the other.

Soluble Solids: The soluble solids fraction of the pollution consists of water soluble compounds which were dissolved by rain or the water in the sootfall gage, or brought down by rain or snow. In this fraction, as with insoluble solids, the largest percentage is of fuel origin and consists of ash, ammonia, sulphur dioxide, hydrogen sulphide, and carbon dioxide. The sodium chloride component is probably of natural origin.

The distribution of soluble solids did not entirely parallel the total and insoluble solids. It was found that Manhattan had a higher level than the other four boroughs although the difference was not so marked as it was for total and insoluble solids. Lower Manhattan and upper Brooklyn received the most soluble solid pollution.

The Distribution of Pollution Around New York City

The City of New York, because of its geographical, industrial, and population characteristics, is peculiarly well suited to a study of the distribution of atmospheric pollution. The Lower East Side of Manhattan is the most concentrated in population and industry of the five boroughs. It also contains the greatest number of public utility power plants. As was to be expected from these conditions it was found to have the most pollution. The other four boroughs are spread around Manhattan fanwise, and lie in an easterly and southerly direction from Manhattan. The prevailing winds for New York City are from the West. Due to these factors and since the important sources of pollution are in the western part of the city, most of the remainder of the city lies downwind from the main source of pollution in Manhattan.

In an attempt to evaluate this relationship more precisely, it was assumed that the most highly polluted area located around sootfall station No. 126 in the Lower East Side acted as a point source for all of the atmospheric pollution in New York City. With this in mind, the yearly averages of the total solids for each station were plotted against the distance of each location from No. 126 (Fig. 4). The graph obtained indicated that pollution decreased as the distance from station No. 126 increased, the rate of decrease becoming smaller as the distance increased. Thus, at seven miles from the center the sootfall was half that occurring at the pollution center, while at 14 mi it was about one-third. The curve tends to become asymptotic to the line: $x = 25$. Eleven of the points shown in the figure did not fit the curve. An investigation of these locations showed most of them to be very near to utility power plants or in the heart of a particularly dirty section of the city. It is probable that the major portion of the pollution in these locations was produced in the immediate vicinity, and hence was affected to only a small degree by distant pollution. The equation of the curve is

$$y = \frac{1}{0.0081 + 0.0012x}$$

where y is the total solids in tons per square

Table 4—Components of the Settled Matter Pollution Average Tons Per Month Per Square Mile (April-December) 1936

District	Total[a] Solids	Total[b] Solids	Insoluble Solids	Ash	Carbon	Tar	Soluble Solids	SO_4 as SO_2	Cl	NH_3	Undetermined Components
Central Park	61	60	40	25	15	0.29	20	6.0	1.1	0.38	12
Washington Heights	65	67	41	28	13	0.36	26	8.9	1.1	0.44	16
Central Harlem	70	66	43	28	15	0.39	23	8.9	1.4	0.51	12
East Harlem	80	78	57	36	21	0.52	21	7.1	1.0	0.54	13
Kips Bay	165	141	112	71	41	0.77	29	8.6	1.3	0.54	18
Lower East Side	176	148	113	68	45	0.76	35	10.9	1.3	0.61	22
Lower West Side	121	105	77	46	31	0.56	28	9.4	1.2	0.47	17
Riverside	98	84	56	35	21	0.42	28	10.2	1.2	0.45	15
MANHATTAN	108	98	71	44	27	0.53	27	9.3	1.2	0.49	16
Fordham	42	45	27	17	10	0.21	18	4.6	0.8	0.29	12
Pelham	52	53	35	26	9	0.65	18	5.2	0.7	0.35	11
Tremont	60	55	29	18	11	1.31	26	7.7	0.7	0.41	17
Morrisania	45	45	27	19	8	0.60	18	4.8	0.9	0.45	12
Mott Haven	95	86	64	38	26	0.46	22	7.1	1.2	0.42	13
Williamsbridge	56	57	38	24	14	0.49	19	5.0	1.0	0.43	12
BRONX	53	55	36	24	12	0.55	19	5.4	0.8	0.37	12
Williamsburg	99	90	58	37	21	0.47	32	10.8	1.3	0.53	20
Red Hook	72	72	50	31	19	0.73	22	7.0	1.1	0.39	14
Ft. Greene	134	123	96	60	36	1.11	27	8.2	1.2	0.38	17
Bedford	49	50	31	19	12	0.38	19	5.7	0.9	0.37	12
Bushwick	80	71	47	24	23	0.42	24	7.0	1.0	0.55	16
Sunset Park	48	44	26	17	9	0.26	18	5.0	0.8	0.51	12
Flatbush	53	57	35	26	9	0.26	22	5.8	0.9	0.40	14
Brownsville	43	43	20	16	4	0.17	23	7.0	1.0	0.55	15
Bay Ridge	47	47	29	22	7	0.23	18	5.7	0.9	0.37	11
Lower Flatbush	45	44	26	17	9	0.19	18	5.5	1.0	0.34	12
BROOKLYN	57	59	37	25	12	0.33	22	4.9	1.0	0.43	14
Astoria	92	80	59	38	21	0.28	21	7.9	1.0	0.47	12
Corona	43	47	29	21	8	0.36	18	6.1	0.9	0.41	11
Flushing	34	34	19	14	5	0.15	15	3.9	0.7	0.28	10
Maspeth	41	36	20	14	6	0.13	16	5.7	0.7	0.37	9
Jamaica West	46	40	22	15	7	0.28	18	6.1	0.8	0.30	11
Jamaica East	49	49	34	25	9	0.52	15	4.1	0.7	0.38	10
QUEENS	44	43	27	19	8	0.25	16	5.2	0.7	0.34	10
St. George	45	43	22	15	7	0.14	21	6.5	1.1	0.38	13
Tottenville	39	39	21	13	8	0.26	18	5.4	0.9	0.30	11
RICHMOND	42	41	22	15	7	0.20	19	5.9	1.0	0.34	12
NEW YORK CITY	55	52	33	22	11	0.38	19	5.9	0.9	0.38	12

[a]Entire year.
[b]April-December.

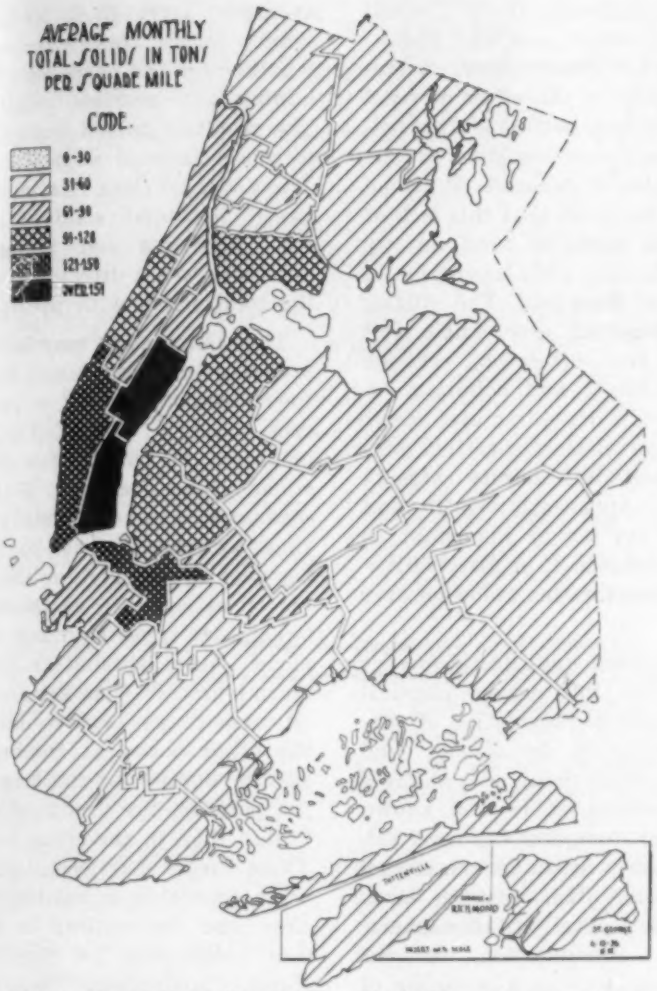

Fig. 3—Sootfall studies in New York City—Average total solids per square mile per month—1936

point consists of two parts: primary and secondary pollution. Primary pollution is that derived from sources in the immediate vicinity of the point in question, and secondary pollution is that pollution carried by the wind to the point in question from sources at various distances away from it. In lower Manhattan, and at other highly polluted parts of the city, the primary and secondary pollution are approximately equal, *i. e.*, the pollution is derived almost equally from the immediate vicinity and from neighboring sources. As the distance from the center of pollution increases, the effect of the secondary pollution on the sootfall level decreases. At a distance of about 10 miles from the center of pollution the secondary pollution is practically negligible and the center of pollution no longer makes its influence felt. At this distance of 10 mi and more, the settled matter values are fairly constant (30-50 tons per square mile). This figure of 30-50 tons may therefore be considered the normal primary pollution for a predominantly residential district.

The relationship between distance and the center of pollution is strikingly shown in Fig. 5. In preparing the data pictured in this

mile, and x is the distance in miles from station No. 126. Similar equations were obtained for the insoluble solid and the soluble solid fractions. They indicate that a halving of the insoluble solids is obtained at a distance of five miles from the center, while a halving of the soluble solids occurs at 12 mi from the center.

Atmospheric pollution at any

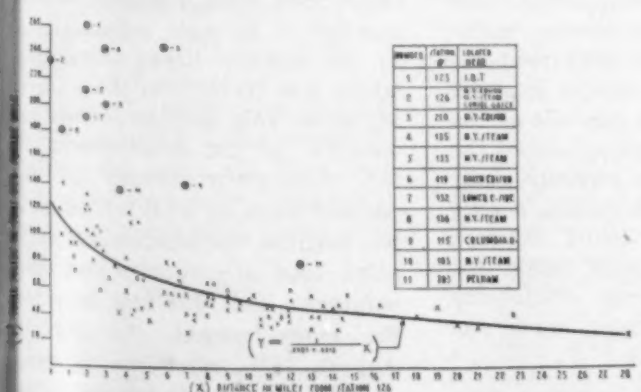

Fig. 4—Effect of distance from center of pollution on average total solids—1936

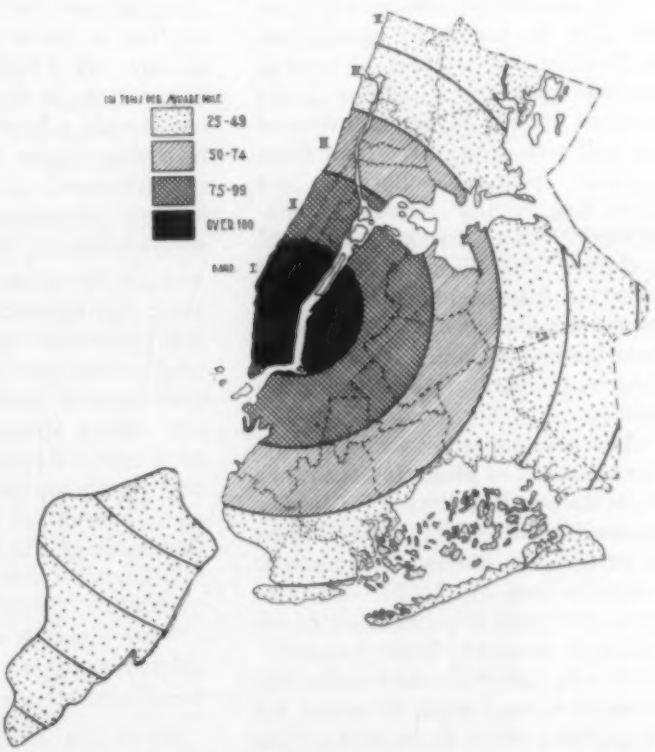

Fig. 5—Distribution of pollution in New York City—1936

map the stations were grouped into five classifications at an interval of three miles, and the average total solids for each group was calculated. The concentric circles drawn around station No. 126 as the common center have therefore radii of three miles, six miles, nine miles, 12 mi, and 15 mi successively, while the shading indicates the pollution value. Band I (0 to three miles from station No. 126) showed the highest pollution. The pollution decreased in Bands II, III and IV but showed no further decrease in Band V. This again would indicate that secondary pollution makes itself felt at increasing distances from the center in diminishing degrees until a distance of about 10 mi is reached. Then the effect of secondary pollution practically disappears, and the constant primary pollution is the only factor. It would therefore seem most important in abating this form of pollution to attack first the sources of secondary pollution in and near lower Manhattan before trying to suppress the evenly distributed low level primary pollution sources throughout the remainder of the city.

The Relation of Atmospheric Pollution to Meteorological Factors

The amount of atmospheric pollution in the air at any given point or locality will depend, of course, on the quantity of matter being emitted by the various sources of air pollution both in the immediate vicinity (primary pollution), and from neighboring sources (secondary pollution). However, since the pollution is air-borne, both types of pollution may be influenced by meteorological factors such as wind velocity and direction, relative humidity, temperature, and precipitation.

The present study included only the relation of climatic conditions to atmospheric pollution in the five boroughs and in New York City as a whole. No attempt was made to correlate meteorological conditions with the level of atmospheric pollution at any one isolated point.

Wind Direction and Velocity: The prevailing wind direction for New York City is westerly. The average wind velocity for the year 1936 was 10.2 mph at the Central Park Observatory, and 14.5 mph at the Whitehall Observatory. A statistical study of the effect of wind velocity on total settled matter pollution gave a very low index of correlation, plus 52 per cent. It should be noted, however, that this lack of correlation refers to wind velocity and not to total wind movement in each major direction. The studies already reported give ample evidence of the correlation between wind movement and pollution. A similar study showed an even lower index of correlation of settled matter with relative humidity (plus 14 per cent). Apparently velocity and humidity are not as important as wind persistence in a given direction in disseminating pollution over the city.

Temperature and Precipitation: Aside from the purely physical changes such as flocculation of particles, variation in density and buoyancy which occur with changes in temperature, it is well known that lower temperatures are followed directly by an increased fuel consumption. This, in turn, leads to a higher level of atmospheric pollution. Precipitation, on the other hand, acts as a scrubber of the polluting elements existing in the atmosphere. It helps to bring about the flocculation of the smaller particles, and the subsequent washing out of these aggregates from the air. As a result of this scrubbing action, in the process of cleaning the air, a large amount of dust is brought down to the earth and is evidenced by an increased amount of settled matter in the sootfall can.

A study of the data for New York City showed a direct relationship between precipitation and total solids and an inverse variation of total solids with temperature. Since Manhattan is so much more polluted than the rest of the city (twice as much as any of the other boroughs), a separate study was made of this borough. A poor relationship was found between precipitation and total solids, but a very close inverse relationship existed between total solids and temperature.

Since the other four boroughs have similar yearly settled matter averages (from 42 to 55 tons per square mile), they were grouped together for the purposes of determining any possible relationship. The results obtained were opposite to those obtained with Manhattan. There was no close relationship between the total solids for these four boroughs and temperature, but there was a direct variation of the total solids with precipitation.

Thus, Manhattan may be called a *temperature* borough and the other four boroughs *rainfall* or *precipitation* boroughs. The following explanation is offered for this peculiar phenomenon. Manhattan consumes approximately three times as much fuel per square mile per year as Brooklyn or the Bronx, ten times as much as Queens, and twenty-five times as much as Richmond. Since Manhattan burns so much more fuel than the rest of the city (more per square mile than the other boroughs combined), a greater number of the larger sootfall particles are produced in Manhattan than in the other boroughs. These larger particles settle near their source in a relatively short time, and the settling is more or less independent of precipitation. Their production, however, is largely proportional to the heating load and is therefore dependent on temperature. In the other boroughs, there is probably a greater concentration of smaller particles than in Manhattan. These remain suspended in the air for longer periods of time and their precipitation to the ground is probably facilitated by rainfall, giving a greater total settled solids with increased precipitation of rain and snow.

The apparent relationship between total solids, temperature and rainfall, is strongly substantiated by the multiple linear correlation which was derived for these three variables. This multiple correlation consisted of the measurement of the relationship between the dependent variable, total settled matter, and the two independent variables, total precipitation and temperature. This was first done for the eight months, January to August, 1936, using the observed data for total solids for the entire city, average temperature, and

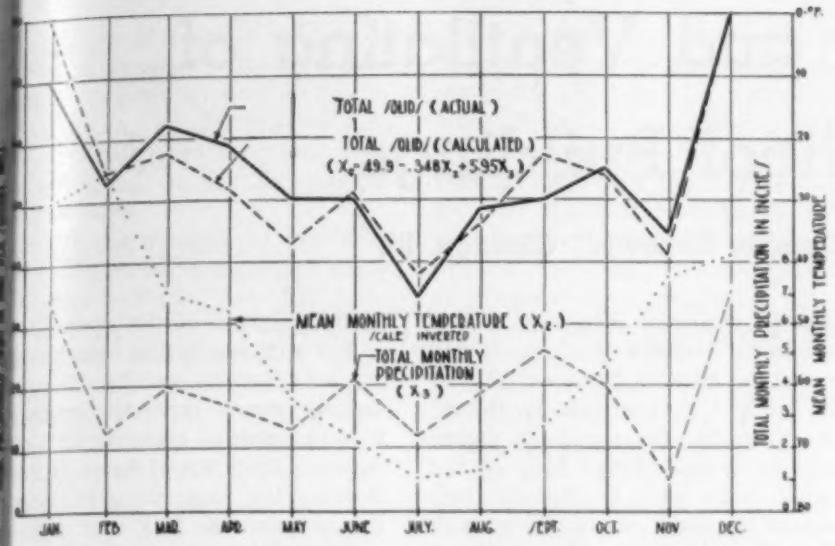
TOTAL /OLID/ (ACTUAL)
TOTAL /OLID/ (CALCULATED)
(X_c = 49.9 - .348X_2 + 5.95X_3)
MEAN MONTHLY TEMPERATURE (X_2)
/CALE INVERTED
TOTAL MONTHLY PRECIPITATION (X_3)
TOTAL MONTHLY PRECIPITATION IN INCHES
MEAN MONTHLY TEMPERATURE
JAN. FEB. MAR. APR. MAY JUNE JULY. AUG. /EPT. OCT. NOV DEC.

Fig. 6—Total solids as affected by temperature and rainfall in New York City—1936

tal precipitation. The equation derived for this period was

$$x_c = 55.5 - 0.321\ x_2 - 4.13\ x_3$$

ere

x_c = the calculated average total solids in tons per square mile per month.

x_2 = the observed average monthly temperatures,

x_3 = observed total precipitation.

his equation was used to predict e total solids values for the onths September to December, 36, before the actual laboratory lues were available, using the nown values of total precipitation, d average temperature for each onth. The deviations from the tual values were +5 tons in Sepmber, —1.2 tons in October, +2 ns in November, and —7 tons in ecember. These predictions from e formula were very close to the tual values. A similar equation btained for the entire year 1936 as $x_c = 49.9 - 0.348\ x_2 + 5.95\ x_3$. The curves for actual and calulated total solids for 1936 are hown in Fig. 6.

The results obtained in this meorological study indicate that the tal settled matter in New York ity varies inversely with temperare, and directly with total precipitation.

Conclusions

1. The total solids settling out n New York City as a whole averaged 55 tons per square mile. or Manhattan it was 108, for the Bronx 53, for Brooklyn 57, for Queens 44, and for Richmond 42.

2. Relative humidity, wind direction and velocity have very little effect on the final pollution in New York City taken as a whole.

3. A multiple correlation study showed that the total settled matter varied inversely with the temperature, and directly with total precipitation.

4. A comparison between New York City and a group of other cities indicates that New York is in a median atmospheric pollution group.

Acknowledgment

Acknowledgment is hereby made of the valuable information abstracted from the Investigation of Atmospheric Pollution by the Department of Scientific and Industrial Research of Great Britain. Free use has been made of the many excellent developments suggested in their various publications and no attempt has been made to give proper reference credit at each point.

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F. W. Hutchinson

PROFESSOR HUTCHINSON AT PURDUE

On July 1 Prof. F. W. Hutchinson joined the faculty of Purdue University, Lafayette, Ind., and as Professor of Mechanical Engineering will teach and do research in the fields of heating, air conditioning, heat transfer and refrigeration.

Formerly, Professor Hutchinson was Associate Professor of Mechanical Engineering at the University of California, Berkeley, from which he graduated in 1937 with the degree of M.S., and in 1938 he received his M.E. degree. He received his B.S. from California Institute of Technology in 1931, and then spent several years in construction work in designing automatic control equipment.

He is the author of several books, and a great many papers which have been published in engineering journals and presented before various societies. In 1937 he joined the ASHVE, and he is also a member of ASRE, IAS, the Tau Beta Pi Engineering Society, Sigma Xi, and the National Research Society.

PROPOSED RATING AND TESTING CODE FOR AIR COOLERS

ASHVE Standards Committee announces that Proposed ASRE Standard Methods of Rating and Testing Forced Circulation and Natural Convection Air Coolers for Refrigeration—listed as *ASRE* Circular No. 25-44—has been received for approval. The Code was prepared by a Joint Committee of the following organizations, ASRE, ASHVE, *ACRMA*, *REMA*. F. H. Faust represented ASHVE.

The proposed Standard is available from ASHVE Headquarters for a period of 60 days to those members of ASHVE who desire to comment or to make suggestions.

Heating and Ventilating of School Buildings

By Samuel R. Lewis,* Chicago, Ill.

THERE HAS been a decided recess in construction, repair and even in maintenance of schools during the past five years. There has been no noticeable recess in the arrival of babies during the past five years. We may, therefore, expect during the next ten years or so a very large volume of school building construction.

Massachusetts and New York particularly pioneered in compulsory ventilation legislation for public schools based around the old 30 cfm per pupil idea and these laws were generally followed throughout the country. It seems now that physicians, engineers and educators have agreed pretty well that delivery of all of 30 cu ft of outside air per minute per pupil is excessive, and the severe New York rules, I am advised, have been repealed.

Wisconsin developed a minutely detailed compulsory ventilation code some years ago and has gradually been relaxing it ever since. Indiana has recently followed Wisconsin with a code that seems not only to require specific results but also attempts to dictate the details as to design velocities, practically writing a specification. Indiana has always been cursed with too many laws dealing with educational matters, with the result that she has been harassed continually and particularly by people who are trying to beat the rules.

In the states of Ohio or Illinois, one finds fewer laws and less law evasion.

After nation-wide experience with compulsory ventilation laws for public school buildings, a rather authoritative committee of the AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS reported that while the ancient 30 cu ft of air per minute per pupil is based on acceptable and intelligent means of aiding the body in temperature control, and may be desirable for air movement, they would be satisfied if 10 cu ft per minute of this air, per pupil, should be brought in from outside, the remaining 20 cfm per pupil being circulated around the body of the pupil. The idea is that by this means the odors can be diluted sufficiently, the chemical conditions oxygen-wise can be maintained adequately, the relative humidity will be less difficult to control and the operating cost will be reduced materially.

Because of the influence of this report there has been a noticeable trend, even in communities where recirculation formerly was rigidly prohibited, toward provision for recirculation of the air within school buildings. Recirculation thus is practiced during the heating period prior to occupancy as well as to a varying extent during occupancy.

Where unit ventilating machines having fans and convectors are installed in class rooms there has been a tendency to arrange the controls so that as long as the average room temperature is cooler than about 70 F the dampers shall be set for 100 per cent recirculation, and no proportion of outside air enters the room until the average temperature within the room exceeds 70 F (or the temperature of thermostatic adjustment).

The dampers in the ventilating units that take air through openings in the walls, usually under the window, are by no means air tight and there is always a considerable leakage. Enough cold air leakage around dampers and through cracks in such units for the cold air to chill the feet of nearby pupils frequently may be observed.

Considering leakage, it should be remembered that no school room is anywhere near air tight, and that tremendous amounts of air pass through window cracks and even through plastered masonry walls under pressure of the wind.

The unit ventilating machine has no easy job of control since its usually single convector must be able to warm as many as 1200 cfm entering from out of doors. It must increase the temperature of this air to approximately 70 F regardless of variations in the entering temperature. The volume of air that must be warmed also varies with wind direction, increasing on the windward side and decreasing on the leeward side. The use of a single bypass damper around the convector in a unit ventilating machine has therefore not proved satisfactory, and it has been necessary to supplement the damper by throttling the supply valve on the pipe serving the convector.

Throttling of steam supply to a convector that is in a mechanically moved sub-freezing air current is not safe unless the drainage of condensate is positive, as by a vacuum pump, and therefore vacuum systems of steam circulation generally are required.

There is a definite noise-abatement problem associated with unit ventilating machines due to the necessity of using miniature-size fans and high speed motors in the small enclosures.

The automatic temperature control arrangements of unit ventilating machines require a duct thermostat in the air outlet from each machine to respond to variations in the delivery temperature and thus prevent cold drafts, together with a second thermostat to control the average room temperature. Sometimes the room thermostat acts as a pilot control for the duct thermostat. Under such an arrangement the room thermostat may call for reduction in temperature and might cause introduction of air so cool as to be objectionable near the unit unless the watchdog duct thermostat should refuse passage of air. This teamwork by a

*Consulting Engr. Member of ASHVE.

room thermostat and a pilot thermostat is employed widely in temperature control of heating equipment for any single room such as an auditorium, and is by no means limited to unit ventilating systems in classrooms.

Under the influence of salesmen for unit ventilating machines there was developed the idea that individual vent flues from each classroom in a school building could just as well be eliminated. If each room has a unit ventilating machine to introduce air, why not simply cut a hole through the wall between each classroom and the corridor and use the entire corridor as a vent duct? There appear interesting possibilities of savings in cost if the vent flues all can be eliminated.

Some buildings were built according to this prescription. The spent classroom air passed up the stairways and entered the attic through grilles in the top story ceiling, escaping from the attic through openings in the roof.

Objections to this arrangement are that in case of fire, the smoke would be forced through the corridors and particularly would obscure the stairways. The corridors, by impartial observation, assuredly are odorous and the spent air rejected by windward rooms tends to enter leeward rooms on windy days despite the efforts of the ventilating machines on the leeward side of the building to maintain pressure.

The older and less commercialized scheme for ventilating school buildings involves centralized fan systems, with or without any radiators in the classrooms. The split system of central ventilation usually has enough radiation to heat the room in the coldest weather, and the mechanically delivered air enters at about 70 F. It may enter the classroom through a single grille overhead in a wall opposite the window-wall or may enter through several ceiling grilles from ducts between the ceiling joists, or may enter through grilles under the radiators through ducts between the floor joists.

If there is a cloak room adjacent to each classroom, the vent opening may be located in the cloak room, usually being near the floor.

One thermostat in each room is used to control the heat supply to the radiators. The temperature of the entering air is controlled by a duct thermostat that serves all the rooms supplied by the central fan, no pilot thermostat ordinarily being needed. Each room has a vent flue and the corridors are not used as passages for spent air.

A modification of the split system eliminates direct radiators from the classrooms. The control of individual room temperature is obtained by varying the temperature of the entering air and this air comes from a central supply system. Means are provided for heating the air going to each room under control of a thermostat in each room.

In some cases the convectors that parallel the service of the radiators of the split system are placed in the air duct risers that supply each room and are controlled by steam supply valves. In others, the convectors are placed in masonry walk-through tunnels and serve groups of nearby rooms, warming the 70 deg air that comes through the tunnel to the necessary temperature, so that there are provided two chambers under fan pressure, one at about 70 deg and one much warmer, say at 100 deg. A double blade mixing damper in the duct or riser that supplies each classroom admits a continuous stream of air to serve each room, varying in temperature as required by the single thermostat in each room.

This all-blast scheme has one decided advantage in that as room after room in each group becomes warm, the mixing damper throttles down the proportion of the hotter air and admits more of the 70 deg air, leaving the hotter air to accelerate the heating of the remaining too cool rooms in each group.

The all-blast scheme is not usually designed to employ the corridors as spent air passages. With both the split system or the all-blast system, vacuum steam circulation is desirable but not imperative, as it is with the unit ventilating machines.

There is an increasing appreciation by engineers of the insidious effect of corrosion of ferrous piping employed in heating systems, especially in steam piping, unless this piping is freely and continuously vented of the gases that are ever-present. Corrosion is rampant especially within the return pipes. If, for example, a condensate return pipe of a vacuum system does not pitch downward toward the pump inlet so that the air and gas passed into it through the various traps is separated and discharged easily, corrosion soon appears.

Lifts in vacuum return pipes that cause pocketing of air under pressure on the radiator sides of such lifts should be avoided. Steam pressures higher than the limits imposed by thermostatic traps should be avoided unless special provisions are made for venting.

One plant designed for operation at 50 psi steam pressure, using float traps, was not vented adequately, and consequently dissolved oxygen and probably carbon dioxide were allowed to accumulate and they promptly indicated their effect by holes through the iron and steel piping, especially on the steam sides of the traps. It is noticeable that the pressure return piping between pumps and boilers tends to require replacement earlier than other pipes and it is suspected that this is due to inadequate separation of the gases that enter with the condensate.

No heating system piping should ever be inaccessible or invisible to a person charged with its maintenance. Only an amateur will be guilty of putting return pipes, for example, in the ground under concrete floors even though these pipes may be threaded through tiling. It is doubtful whether a heating pipe must ever imperatively be placed below a ground floor, but if there is no avoidance, then there should be a masonry tunnel large enough so that men can work within it and can keep it dry and clean, or as a last expedient a masonry trench with a removable metal cover should be provided.

One line of reasoning concerning pipe corrosion and boiler incrustation in school buildings has led to the use of hot water as a heat carrier in lieu of steam. One very large high school building plant using water has been operated about ten years. The water is pumped directly through the boilers and circulates mechanically to

radiators above or below the mains, whichever happens to be convenient. The water is used in convectors to heat the entering air and to reheat the recirculated air, the volume of which is several hundred thousand cubic feet per minute.

Maintenance and fuel costs have been so low and general satisfaction has been so great in this system that hot water is to be used in four more schools now being designed.

One may think of the analogy between heat distribution within an animal and that within a building. Nature apparently avoided use of gas, like steam, in arteries and veins and consistently employs mechanically circulated liquid, like water. Woe betide the animal if air gets into an artery. Let this be a lesson to us to keep our piping systems well vented!

PETERSON, HOFFMAN & ASSOCIATES ORGANIZE

The firm of Peterson, Hoffman and Associates, architects and engineers, 1051 Spitzer Bldg., Toledo, Ohio has been formed by Roy T. Peterson and Charles F. Hoffman.

Mr. Peterson is a graduate of the University of Michigan, 1929, and has a wide experience in the architectural field in Ohio, Michigan, Pennsylvania and New York and is a Member of the American Institute of Architects.

Mr. Hoffman graduated from Syracuse University in 1922 and has been active in the field of heating, ventilating, air conditioning and sanitation in Ohio, Michigan, New York and Maryland. He is a member of the ASHVE and the National Society of Professional Engineers.

JOHN E. HAINES MANAGER OF NEW COMMERCIAL CONTROLS DEPARTMENT

Formation of a new division known as the Commercial Controls Department with John E. Haines as manager, has been announced by C. B. Sweatt, vice president, Minneapolis - Honeywell Regulator Co., Minneapolis, Minn.

Mr. Haines, who until his new appointment had been manager of the company's Air Conditioning Controls Division, joined Minneapolis-Honeywell in August, 1929. A graduate of Purdue University, where he received his degree in chemical engineering, Mr. Haines became assistant manager of the Modutrol Division in 1934 and subsequently served as manager of the National Regulator Division until his appointment to the Air Conditioning Controls Division in 1940.

He has been a member of the American Society of Heating and Ventilating Engineers since 1940.

John E. Haines

The Commercial Controls Department encompasses six sales divisions of the company, namely: Air Conditioning Controls Division, Moduflow Division, Railway Controls Division, Apartment Controls Division, Refrigeration Controls Division and the Aeronautical Division.

Mr. Sweatt also announced the promotion of two new zone managers in the Air Conditioning Controls Division. They are H. R. Canoyer as sales manager of the Central Zone with headquarters in Cleveland and M. S. Hamilton, as sales manager of the Southeastern Zone with headquarters in Atlanta.

KANSAS CITY CHAPTER REPRESENTATIVES ON TECHNICAL COUNCIL

Seventeen professional and technical societies of the Kansas City area joined forces in establishing the Technical Societies Council and D. M. Allen and J. M. Arthur were elected to represent Kansas City Chapter of ASHVE.

At the organization dinner-meeting held in Kansas City July 9, Dr. W. M. Hoehn, member of the American Chemical Society and laboratory director of the George A. Breon & Co., was elected chairman; C. M. Lytle, Missouri Society of Professional Engineers, with the Kansas City Power & Light Co., vice-chairman; and Charles Briggs, member of the American Society of Mechanical Engineers, with the Burns & McDonnell Engineering Co., secretary-treasurer.

A monthly bulletin will be published programming activities of all organizations. Some of the principal objectives to be advanced immediately include support for establishing better technical and scientific libraries in this region; encourage the establishment of educational courses of a technical and scientific nature in the schools of this area and co-ordinate the vocational guidance activities of the constituent organizations; to co-operate with civic, educational and government agencies in matters requiring professional assistance.

Headquarters for the newly formed Council will be in the offices of the Midwest Research Institute, Kansas City. Miss Sarah C. Lechman, a member of the Institute's staff will be manager of publications.

Each of the seventeen organizations elected two delegates to the Council. The organizations and delegates are:

American Chemical Society.....Dr. W. M. Hoehn, L. S. Deatley
American Institute of Architects.....Albert B. Fuller, Henry Krug
American Meteorological Society.....G. A. Hollingsworth, Dr. Sidney Ekblaw
American Institute of Electrical Engineers.....Max Bretschneider, A. F. Hartung
American Society of Heating and Ventilating Engineers.....D. M. Allen, J. M. Arthur
American Society of Mechanical Engineers.A. C. Kirkwood, Charles Briggs
American Society for Metals.....C. K. Kenyon, C. Chilson
American Society of Safety Engineers.Theodore Bianch, A. N. Chapman
American Welding Society.....D. D. DeBrunner, H. R. E. Austin
Association of Cereal Chemists.....J. M. Doty, Dr. Wendell Reeder
Engineer's Club of Kansas City.....W. H. Baum, Harry Shideler
Illuminating Engineering Society.....H. L. Hutchinson, M. A. Havenhill
Institute of Radio Engineers.....R. N. White, A. P. Stuhrman
Midwest Research Institute.....Dr. George E. Ziegler, Dr. Carl M. Marker
Missouri Society of Professional Engineers.....C. M. Lytle, R. E. Welch
American Society of Refrigerating Engineers.C. H. Garrison, E. G. Morgan
American Society of Civil Engineers...Clare R. Van Orman, M. P. Hatcher

Cleveland Center for Council, Committee, Chapter Meetings and Research Laboratory Inspection October 6-8

THE PROGRAM of Society activities scheduled for Cleveland on October 6-8 includes a meeting of the Council, the Committee on Research, and a meeting of the Northern Ohio Chapter.

Of exceptional interest to the members will be the general inspection of the Research Laboratory, 10700 Euclid Avenue. This occasion will provide an opportunity for members to meet the Laboratory staff, see some of the work that has been started and hear some of the results of recent investigations which will be presented at that time.

Prof. G. L. Tuve, chairman of the Committee on Research, has announced a meeting of the Committee on Research at the Laboratory on October 6, as well as a series of meetings of Technical Advisory Committees.

Pres. C.-E. A. Winslow has called a meeting of the Council at the Hotel Statler, Cleveland, at 10:00 a. m., October 7.

The Research Laboratory inspection is scheduled for 10:00 a. m., Monday, October 8, and Director Tasker will be ready to receive the members and guests.

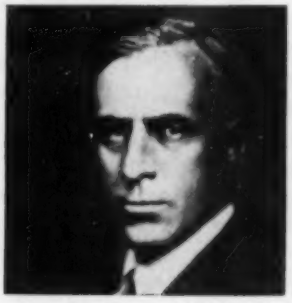
In the afternoon a Technical Session will be held in the Pine Room, Hotel Statler, at which three technical papers will be presented, and this will be followed by a social hour sponsored by the Northern Ohio Chapter. At 6:30 a dinner will be served in the Euclid Room of Hotel Statler, and the speaker will be C.-E. A. Winslow, whose subject is The Air-Cooled Human Body.

G. B. Priester, president of Northern Ohio Chapter, has announced that the committee in charge of arrangements is J. E. Wilhelm, General Chairman, D. L. Taze, Chairman of Reception, D. E. Mannen, Jr., Chairman of Dinner and Program, E. F. Morse, Chairman of Publicity, and John James, Treasurer.

The visiting members who attend are cordially invited by the Officers of the Northern Ohio Chapter to participate in the program and to attend the dinner.

W. L. Fleisher

A. C. Willard



E. Holt Gurney

E. N. McDonnell

J. H. Walker

ASHVE Research Financing Planned

B. M. Woods

A SPECIAL COMMITTEE on Research Fund Raising is announced by Pres. C.-E. A. Winslow, and its membership is: Dr. A. C. Willard, President of University of Illinois, Urbana, Ill.; W. L. Fleisher, Consulting Engineer, New York, N. Y.; E. Holt Gurney, President, The Gurney Foundry Co., Ltd., Toronto, Ont., Canada; E. N. McDonnell, President, McDonnell & Miller, Chicago, Ill.; J. Herbert Walker, Vice-President, The Detroit Edison Co., Detroit, Mich.; and Dr. B. M. Woods, Director of University Extension, University of California, Berkeley, Calif.

The objective of the Committee is to supervise the fund raising campaign for the Society's enlarged program of research at its Laboratory in Cleveland and cooperating institutions. The goal set for the Committee to meet current research needs is budgeted at $110,000 for the next three years. The Committee will announce its plan

shortly in communications to Society members and to the heating, ventilating, air conditioning industries at large.

All of the committee members are well known in the industry and have been actively connected with Society activities for many years. Three of the members are past presidents of the Society, two have served as chairmen of the Committee on Research, and two have acted as technical advisers to the Committee.

For 25 years the ASHVE has conducted its own Research Laboratory, and its reports published in the Transactions and elsewhere have provided fundamental data for engineers, which have been vital in both peace and wartime. Members of the Society participate directly in the support of the Society's research because of the 40 per cent allotted from each member's annual dues to the Research Fund.

Research Programs are conducted under the direction of the Committee on Research, which Committee is elected by the Society membership. The value of the research results available to members and the allied industries cannot be estimated, and in the present accelerated pace of technical advancement there is great promise for the future, the extent of which no individual can fully visualize. The Committee, therefore, feels that the proposed budget for research is a modest one and should receive the prompt and enthusiastic support of the heating, ventilating, air conditioning industry.

GAYLORD RETURNS, LITTLE AND SANBERN PROMOTED BY HOFFMAN

The return of Frank H. Gaylord as Vice-President in charge of Market Development of Hoffman Specialty Co., Indianapolis, Ind., is announced by Neil D. Skinner, Executive Vice-President. During the past year Mr. Gaylord has been associated with Economy Pumps, Inc., Hamilton, Ohio, as Commercial Vice-President, devoting most of his time to a comprehensive study of the industrial and municipal pump field, sales organization work and new pump applications, and this program is now completed. Before undertaking this special study for Economy, Mr. Gaylord spent 25 years with the Hoffman Specialty Co. as Supervisor of Western Territories, Vice-President and Director. Mr. Gaylord resumes his personal contacts with leading heating and plumbing wholesalers, contractors, architects, and others selling and installing the Hoffman line of valves, traps, and hot water controlled heat, and he also will continue promoting the interests of the Hoffman-Economy vacuum and condensation pumps.

Mr. Gaylord joined the ASHVE in 1921 and has always taken an active interest in the affairs of the Illinois Chapter and in the meetings of the Society.

To meet the peacetime demands, announcement of other appointments was made by Mr. Skinner. Effective at once, C. W. Little will be Assistant General Sales Manager, working under the direction of C. W. Stewart, Vice-President and General Sales Manager. Mr. Little has been actively identified with the sale of heating, ventilating, air conditioning equipment during the past 17 years, and since October 1939 he has been with Hoffman as zone manager of the New England and New York State area. Prior to that he was with General Electric, Delco, and Anthracite Industries, Inc.

A newly created Hoffman Jobber Products Division will be in charge of E. Nute Sanbern as manager, and he will conduct an educational and sales program among wholesalers, contractors and architects. Mr. Sanbern has been associated with Hoffman for a period of 11 years and his fine engineering background especially fits him for this new and bigger sales work.

Mr. Sanbern joined the ASHVE in 1923 and was an active member in the Philadelphia Chapter, serving as its Treasurer in 1928 and 1929, Vice-President in 1930, and as President in 1931.

Clark M. Humphreys

CLARK HUMPHREYS JOINS LABORATORY STAFF

On September 1, Clark M. Humphreys came to the Research Laboratory of the AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, Cleveland, Ohio, as Senior Engineer. He has an extensive background of training in the mechanical engineering field and a wide experience in heating and ventilating design, as well as a fine record as a teacher and a writer on technical subjects.

For many years he was on the staff of Carnegie Institute of Technology, Pittsburgh, in charge of instruction in heating, ventilating, air conditioning, and plumbing.

Mr. Humphreys was born in Kenton, Ohio, and after graduating from its public schools he attended Ohio State University, where he received his B.M.E. in 1925.

After six years service in the office of the State Architect and Engineer, Columbus, where he prepared designs and specifications of heating, ventilating, and plumbing systems for state buildings and in-

Frank H. Gaylord

E. Nute Sanbern

C. W. Little

and described packaging to reduce the O_2 to a minimum

Editor, Architectural Forum. He outlined many of the

stitutions, he joined the teaching staff of Carnegie Tech in 1931.

In that same year he became a member of ASHVE and served on the Council from 1936-38, inclusive. He was chairman of the Guide Publication Committee in 1942, and he has served on many of the research technical advisory committees including Weather Design Conditions, Air Flow in Ducts, and Instruments.

In Pittsburgh he took an active interest in the work of the Local Chapter of the ASHVE, and served as its president in 1942 and as a member of its Board of Governors in 1943.

While still on the staff of Carnegie Tech, Mr. Humphreys acted as Director of the Society's Research Laboratory at Pittsburgh during part of 1942 and 1943, after the late Dr. Ferry C. Houghten was called into active service with the Navy.

His immediate field of activity at the Research Laboratory will be concerned with the building of the new psychrometric rooms and the studies to be made on radiation and comfort.

CANADIAN CAPERS

By John S. Meyer*

The "WOW-TIME" joint golf party of the Western New York Chapter, ASHVE, and the Indoor Climate Council has been acclaimed, by all in attendance, as the outstanding summer social affair held in the Buffalo area.

On Thursday, August 10, the journey was made to the Cherry Hill Golf Club, located at Ridgeway, Ontario, Canada. More than 50 made the trip due to the excellent promoting of Walter P. Davis, Secretary for the Joint Committee.

Walter Voisinet, President of Indoor Climate Council, was chairman of the Joint Golf Party and was ably assisted by Dave Mahoney and Joe Davis. Such an able committee means sure success to any party held by ASHVE.

During the afternoon of a beautiful day, golf held full attention with Walter Voisinet leading the field for low net score and Bill Seelbach a close second. Had Eddie Landt not had the misfortune to twice step on his ball while putting, he would have copped first honors.

The affable and well-liked "L. P." Saunders (National Treasurer) was suitably rewarded for being the best dressed golfer, while Walter Davis was acclaimed the poorest golfer of the day, even though he scored a 3 on a par 5 hole.

"Little Bill" Eisele, as usual, was the card champ and thinks that something will have to be done about providing better competition at future parties. Al Moesel, President of the Chapter, instead of playing golf, sat it out with Allen Schnell, and settled ALL international affairs.

Honors were evenly divided for the position of the Social Lion among 14 members, and despite long concentration the matter remains as unfinished business.

The highlight of the lobster dinner was the demonstration of that Master of Masters of Ceremonies, Joe Davis, the most popular member in Western New York, who, as usual, handled the job of M. C. like the folks on a Vox Pop program.

Everyone present had such a good time, it was decided to permit the Joint Committee to remain active for another year as a reward for their efforts. Walter Voisinet, Dave Mahoney, Joe Davis and Walter Davis may take a bow.

*Secretary, Western New York Chapter of ASHVE.

SUMMARY OF LOCAL CHAPTER MEETINGS*

ATLANTA—May 7. Subject: Heating and Air Conditioning in Latin American Countries. Speaker: Alfred J. Offner, First Vice-President of ASHVE, New York, N. Y. Mr. Offner's talk covered his own experiences along engineering lines in these countries. E. R. Foss submitted his report as Treasurer. Attendance, 40. Attendance ratio, 0.75.

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NORTH TEXAS—July 16. Subject: The American Spirit. Speaker: Judge T. Whitfield Davidson. E. J. Stern presided in absence of the president. Attendance, 36. Attendance ratio, 0.69.

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NORTHERN OHIO—May 14. Subject: Heat Loss Through Glass. Speaker: G. V. Parmelee, Research Fellow, ASHVE Research Laboratory, Cleveland, Ohio. Reports were given by the chairmen of the Membership, Program, Publicity, Attendance, Entertainment, By-Law, Auditing and Nominating Committees. The following officers were unanimously elected for the year 1945-46: *President*, G. B. Priester; *Vice-President*, J. E. Wilhelm; *Secretary*, R. L. Byers; *Treasurer*, John W. James. *Board of Governors*, Walter Baggaley, P. B. Sagar, and A. L. Vanderhoff. Attendance, 67. Attendance ratio, 0.77.

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SOUTHERN CALIFORNIA—June 22. Subject: Post-War Quick Freezing for Domestic and Commercial Application. Speaker: D. K. Tressler, Managing Director, General Electric Consumers Institute. He traced the quick freezing dates back to Civil War times when patents were issued for freezing fish in metal cans packed with salt and ice, which became an important industry in 1880, and was followed by freezing of meats and poultry. Freezing of fruits, he explained, had its important growth between 1904 and 1910, after which many items were included up to very recently with the freezing of eggs and cream.

Mr. Tressler briefly covered the methods and difficulties in processing. The quicker the temperature drop, the better the process. Therefore, direct immersion in the brine would be the most satisfactory. He then made a comparison of the vitamin C loss in peas at varying temperatures. He explained the results of oxidation

Note. The attendance ratios shown above represent the meeting attendance divided by the chapter membership. These ratios will be useful as a partial indication of interest shown by local chapter members in various types of subjects programmed by the various chapters and may be useful in deciding on subjects for chapter meetings.

HENZE, ARTHUR L., Mech. Engr., Walter Scholer, Lafayette, Ind. G. B. Supple C. N. Warren

and described packaging to reduce the O_2 to a minimum and hold the moisture in. He outlined the future possibilities, stressing the opinion that the home unit would supplement and increase the commercial packers, expressing his belief that the following equipment may be expected to expand: Home cabinets to supplement locker plants; home freezing cabinets; locker plants to offer preparation service and bulk storage; freezing of cooked foods (complete meals); and freezing of baked goods (pies, bread, cakes). The installation of officers followed. Attendance, 89. Attendance ratio, 0.85.

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WASHINGTON, D. C.—May 9. Subject: New Homes and New Materials. Speaker: Paul Jerman, Technical Editor, Architectural Forum. He outlined many of the factors affecting the development of postwar housing. He foresaw sufficiently rapid development to require aggressive initiative from the heating and ventilating profession to keep abreast of modern housing. He concluded by showing many slides illustrating modern trends in domestic, office building, apartment house, and factory architecture. The Tellers of Election, M. F. Hoppe, J. C. Benson and A. C. Crawford, reported the following elected for the coming year: *President*, W. H. Littleford; *Vice-President*, L. B. Nye; *Secretary*, Lester Maurer; *Treasurer*, M. F. Hoppe; *Board of Governors*, J. W. Markert, F. B. Sale, and H. H. Hill. Mr. Markert then introduced the new president and presented him with the gavel. Attendance, 65. Attendance ratio, 0.54.

Candidates for Membership

The Constitution of the Society, as now amended, requires the following mode of procedure in voting on applicants for membership in the Society. All applications for membership are to be sent to the Secretary and the names of applicants and their references shall be printed in the next issue of the Journal of the Society or sent to the members in other approved manner as ordered by the Council. When replies are received from references, the Candidate's application shall be submitted to and acted upon by the Committee on Admission and Advancement as soon as possible.

When the Committee on Admission and Advancement has acted favorably upon a Candidate's application and assigned his grade, the Council shall vote upon the election of the proposed Candidate for membership by letter ballot. During the past month 43 applications for membership have been received and the names of these men and their sponsors are published in the following list.

Members are requested to scrutinize the list with care. The Committee on Admission and Advancement, and in turn, the Council, urge members to assume their share of responsibility of receiving these candidates into membership by advising the Secretary promptly of any whose eligibility for membership is in any way questioned.

All correspondence in regard to such matters is strictly confidential, and is solely for the good of the Society, which it is the duty of every member to promote.

Unless objection is made by some member by September 17, 1945, these candidates will be balloted upon by the Council. Those elected to membership will be notified by the Secretary immediately after election.

CANDIDATES	REFERENCES	
	Proposers	*Seconders*
ASH, NORMAN B., Pres., Braniff Engineering Co., Oklahoma City, Okla.	E. T. P. Ellingson C. Y. Trowbridge	E. W. Gray G. T. Donceel
BARBER, RICHARD C., U. S. Navy, % F.P.O., San Francisco, Calif.	G. E. Williams Dale Trenhaile	*G. P. Stein *W. J. Pauley
BAUER RAY F., Engr., J. M. O'Connor Co., Wichita, Kans.	Henry Kleinkauf H. D. Betz	W. R. White B. G. Peterson
BEARSE, ALLEN H., Jr., New England Mgr., The Anthracite Industries, Inc., Boston, Mass.	J. M. Kipe R. C. Johnson	A. J. Johnson R. A. Protheroe
BLADEN, ARTHUR M., Owner, Neller, Rich & Bladen, Chicago, Ill.	A. O. May E. P. Heckel	S. I. Rottmayer S. R. Lewis
BURTON, CHARLES C., Mech. Engr., Johns Manville International Corp., New York, N. Y.	C. S. Pabst W. T. Wrightson	C. R. Campion E. E. Adams
CADENAS, MANUEL A., Student, Massachusetts Institute of Technology, Cambridge, Mass.	James Holt G. B. Wilkes	*C. L. Svenson B. J. Steinke
CLARK, DWIGHT L., Air Cond. Teacher, Bremerton High School, Bremerton, Wash.	D. C. Griffin E. L. Weber	W. E. Beggs E. H. Langdon
DAUSSAT, WALDO J., Chief Engrg. Draftsman, Hq. Eighth Naval Dist., New Orleans, La.	Marcel Livaudais W. H. Dudley, Jr.	C. B. Gamble L. V. Busenlener
DEUBEL, JUSTIN A., Devlpt. Engr., Perfex Corp., Milwaukee, Wis.	L. B. Miller M. W. Crew	J. R. Vernon H. W. Schreiber
DIETZ, LEWIS H., Owner, Pacific Engineering Equipment Co., Glendale, Calif.	R. E. Daly G. M. Maier	L. N. Hunter P. B. Holmes
FLETTRICH, HAROLD L., Service Mgr., Hans F. W. Rasmussen & Sons, New Orleans, La.	C. B. Gamble W. H. Dudley, Jr.	L. V. Busenlener E. O. Thoman
GRIGG, JAMES L., Asst. Mgr., Sheet Metal Dept., American Sheet Metal Co., Norfolk, Va.	W. H. Webster, Jr. F. T. J. Miller	*R. F. Dallas *B. P. Eccles
GROTH, DON R., Dist. Mgr., U. S. Air Conditioning Corp., Oklahoma City, Okla.	E. T. P. Ellingson C. Y. Trowbridge	E. W. Gray G. T. Donceel
GSCHWIND, J. F., Devlpt. Engr., J. O. Ross Engineering Corp., New York, N. Y.	J. O. Ross W. L. Fleisher	D. A. MacWatt W. E. Heibel
HAMLIN, M. R., Dist. Repr., Warren Webster Co., Columbus, Ohio.	R. D. Ashley H. R. Allonier	G. L. Long R. B. Breneman

HENZE, ARTHUR L., Mech. Engr., Walter Scholer, Lafayette, Ind.

HERRICK, MARVIN M., Applica. Engr., Johnson Service Co., Milwaukee, Wis.

INGERSOLL, ROBERT S., Works Mgr., Ingersoll Steel & Disc Div., Borg-Warner Corp., Kalamazoo, Mich.

ISKYAN, HAIG S., Research Engr., Curtiss Wright Corp., Buffalo, N. Y.

JOHNSTON, JAMES O., Htg. Engr., City Fuel Oil Co., St. Petersburg, Fla.

JOHNSTON, LOWELL T., Supvsr., Johnston Bros. Fuel Co., St. Petersburg, Fla.

KELLER, ARTHUR B., Staff Engr., Plant Engrg. Dept., Corning Glass Works, Corning, N. Y.

KIMBLE, CARL W., Owner, Advance Heating & Sheet Metal Works, Rock Island, Ill. (*Advancement*)

KOTTCAMP, HARRY E., Owner, C. C. Kottcamp & Son, York, Pa.

MALONE, JOHN F., Asst. Mgr., Dist. Steam Dept., Consolidated Gas Electric Light & Power Co. of Baltimore, Baltimore, Md.

MCKEE, JAMES M., Engr., Payne Furnace Co., Beverly Hills, Calif.

MILLER, WILLIAM P., Engr., The Smith & Oby Co., Cleveland, Ohio.

PECK, JOSEPH W., Naval Archt., U. S. Naval Drydocks, Hunters Point, San Francisco, Calif.

PETERSON, HOWARD H., Cons. Engr., Yakima, Wash.

POYTHRESS, JOHN D., Engr., W. E. Lewis & Co., Dallas, Tex.

REYNOLDS, JAMES C., Air Cond. Service Engr., Westinghouse Electric Corp., Pittsburgh, Pa.

ROCHE, JOHN M., Field Engr., Sarco Co., Inc., Chicago, Ill.

ROSE, JAMES S., Branch Mgr., Ilg Electric Ventilating Co., San Francisco, Calif.

SANDERS, VIC, Engr., Pittsburgh Corning Corp., Pittsburgh, Pa.

STRAUCH, PAUL C., Sales Engr., Sears-Piou & Co., St. Louis, Mo. (*Advancement*)

TRENHAILE, DALE T., Mech. Engr., U. S. Navy Yard, Pearl Harbor, T. H.

TURNER, WILLIAM M., Supvsg. Engr., The Ripstra Co., Wichita, Kans.

VERAZA, CARLOS, Mgr., Madrigal y Veraza S. de R.L., Mexico, D.F.

WATKINS, WILBURN O., Design & Erection Engr., Nevada Electric Co., Las Vegas, Nev.

WIEDEMAN, WALTER, Owner, Reeves Wiedeman Co., Kansas City, Mo.

WITTENMEIER, F. G., Vice-Pres., Wittenmeier Machinery Co., Chicago, Ill.

WRIGHT, JOHN F., Vent. & Methods Engr., Servel, Inc., Evansville, Ind.

G. B. Supple W. T. Miller	C. N. Warren S. E. Fenstermaker
H. W. Schreiber J. R. Vernon	M. W. Bishop E. W. Gifford
H. R. Limbacher *L. S. Gifford	S. H. Downs W. G. Schlichting
W. E. Voisinet Herman Seelbach, Jr.	W. E. Crowell S. W. Strouse
H. G. Carter B. A. Thomas	Richard Barthelmess F. J. Beckwith
B. A. Thomas H. G. Carter	Richard Barthelmess F. J. Beckwith
Roswell Farnham W. T. Miller	J. Q. Treadway L. M. Hakes
E. O. Olson R. H. Nelson	H. W. Nelson C. S. Stock
J. J. Mirabile E. R. Walsh, Jr.	*L. S. Morse, Sr. *C. H. Neiman, Jr.
J. E. Seiter E. L. Crosby	R. L. Leilich E. H. Taze
Art Theobald A. B. Banowsky	Leo Hungerford R. J. Petersen
H. E. Wetzell Walter Klie	E. W. Gray Philip Cohen
J. F. Kooistra K. O. Alexander	*R. R. Stewart *S. D. Rains
R. E. Le Riche W. E. Barnum	S. D. Peterson E. O. Eastwood
J. A. Ray C. R. Gardner	H. L. Jones V. G. Cox
E. C. Hach L. G. Huggins	J. J. Tillotson W. A. Minkler
E. J. Ritchie A. O. May	J. S. Kearney R. W. Cumming
C. E. Parks James Gayner	F. W. Kolb N. H. Peterson
R. A. Miller L. K. Jones	S. F. Cox O. D. Englehart
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E. M. Mittendorff J. S. Locke	J. F. Cummiskey A. L. Crump
H. C. Pierce J. K. Knighton	J. R. Colby F. A. Grossman

*Non-member.

Candidates Elected

In the past issues of the Journal of the Society the names of the following men were listed as Candidates for Membership. The membership grade of each Candidate has been assigned by the Committee on Admission and Advancement and balloted upon by the Council. We are now instructed by the Council to post herewith, as required by Art. B-III, Sec. 8, of the By-Laws, the following list of candidates elected:

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BEKESHUS, J. HERBERT, Devlpt. Engr., York-Shipley, Inc., York, Pa.

DOWNING, CLAIRE A., Research Engr., Vermiculite Research Institute, Evanston, Ill.

ESSEX, J. L., Mineral Products, San Antonio, Tex. (*Reinstatement*)

FLETCHER, SAXTON W., Pres., J. O. Ross Engineering Corp., New York, N. Y. (*Reinstatement*)

GILFRIN, GEORGE F., Mexico, D. F. (*Reinstatement*)

GILLHAM, WALTER E., Cons. Engr., Kansas City, Mo. (*Reinstatement*)

MARKS, ALEXANDER A., Director of Research, Richmond Radiator Co., Uniontown, Pa. (*Advancement*)

PATRICK, HORACE M., Cons. Engr., Bernardsville, N. J. (*Reinstatement*)

SAMPSON, WILL D., Dallas, Tex. (*Reinstatement*)

SCHWITZER, LOUIS, JR., Exec. Vice-Pres., Schwitzer-Cummins Co., Indianapolis, Ind.

WARREN, G. RICHARD, Mech. Engr., North American Aviation, Inc., Kansas City, Kans.

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PONS, RAYMOND A., Partner & Mgr., Pons & Davis, Salt Lake City, Utah.

STOLKER, EDWARD A., Owner, Stolker Engineering Co., Philadelphia, Pa.

WESLEY, WILLIAM, Owner, Wesley Refrigeration Service, Rome, N. Y.

American Society of Heating and Ventilating Engineers

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(Tel.: AShland 4-0291)

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22. **Weather Design Conditions:** Capt. T. H. Urdahl,* *Chairman;* J. C. Albright, C. E. Bentley, R. E. Biller, H. S. Birkett, J. F. Collins, Jr., Lt. Comdr. John Everetts, Jr., J. P. Fitzsimons, Capt. J. D. Kroeker, Comdr. F. W. Reichelderfer, H. C. S. Thom.

*Member of Committee on Research.

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Central New York: Organized, 1944. Headquarters, Syracuse, N. Y. President, C. M. Ashley, 300 S. Geddes St., Syracuse 1. Secretary, F. E. Hockensmith, 400 N. Midler Ave., Syracuse.

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Connecticut: Organized, 1940. Headquarters, New Haven, Conn. President, Stanley Hart, New Britain. Secretary, Winfield Roeder, 405 Temple St., New Haven.

Delta: Organized, 1939. Headquarters, New Orleans, La. Meets, Second Tuesday. President, W. H. Grant, Jr., 209 Vincent Bldg., New Orleans 12. Secretary, J. S. Burke, 317 Baronne St., New Orleans 9.

Golden Gate: Organized, 1937. Headquarters, San Francisco, Calif. Meets, First Wednesday. President, R. B. Holland, 420 Market St., San Francisco 11. Secretary, F. W. Kolb, 598 Monadnock Bldg., San Francisco 5.

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Kansas City: Organized, 1917. Headquarters, Kansas City, Mo. Meets, First Monday, President, R. B. Mason, 2014 Wyandotte St., Kansas City. Secretary, P. C. Leffel, 316 E. 75th St., Kansas City.

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Massachusetts: Organized, 1912. Headquarters, Boston, Mass. Meets, Third Tuesday. President, D. M. Archer, 143 Federal St., Boston 10. Secretary, A. Ehrenzeller, 23 Parklawn Rd., Boston 32.

Memphis: Organized, 1944. Headquarters, Memphis, Tenn. Meets, First Monday. President, T. J. O'Brien, 1030 Exchange Bldg., Memphis. Secretary, A. T. Bevil, 1521 Waverly Ave., Memphis 6.

Michigan: Organized, 1916. Headquarters, Detroit, Mich. Meets, First Monday after 10th of month. President, R. F. Connell, 1500 United Artists Bldg., Detroit 31. Secretary, A. E. Knibb, 1003 Maryland Ave., Detroit 30.

Minnesota: Organized, 1918. Headquarters, Minneapolis, Minn. Meets, First Monday. President, R. E. Gorgen, 2120 W. Cedar Lake Blvd. Secretary, O. L. Lilja, 5000 16th Ave. S., Minneapolis 7.

Montreal: Organized, 1936. Headquarters, Montreal, Que. Meets, Third Monday. President, A. B. Madden, 1170 Beaver Hall Sq., Montreal, Que. Secretary, Leo Garneau, Room 832, Dominion Sq. Bldg., Montreal, Que.

Nebraska: Organized, 1940. Headquarters, Omaha, Nebr. Meets, Second Tuesday. President, D. E. McCulley, 814 S. 14th St., Omaha 2. Secretary, D. D. Williams, Rm. 311, Federal Bldg., Omaha.

New York: Organized, 1911. Headquarters, New York, N. Y. Meets, Third Monday. President, H. J. Ryan, 101 Park Ave., New York 17. Secretary, Carl H. Flink, Room 3000, 51 Madison Ave., New York 10.

North Carolina: Organized, 1939. Headquarters, Durham, N. C. Meets, Quarterly. President, K. W. Selden, Jr., 701 Builders Bldg., Charlotte 2. Secretary, E. S. DeWitt, 1211 Commercial Bank Bldg., Charlotte.

North Texas: Organized, 1938. Headquarters, Dallas, Tex. Meets, Third Monday. President, E. T. Gessel, 610 Thomas Bldg., Dallas 1. Secretary, C. Rollins Gardner, 911 Camp St., Dallas 2.

Northern Ohio: Organized, 1916. Headquarters, Cleveland, Ohio. Meets, Second Monday. President, G. B. Priester, 10900 Euclid Ave., Cleveland 6. Secretary, R. L. Byers, 448 Terminal Tower, Cleveland 13.

Oklahoma: Organized, 1935. Headquarters, Oklahoma City, Okla. Meets, Second Monday. President, Earle W. Gray, Third & Harvey Sts., Oklahoma City. Secretary, G. T. Donceel, Oklahoma Natural Gas Co., Oklahoma City.

Ontario: Organized, 1922. Headquarters, Toronto, Ont. Meets, First Monday. President, J. P. Fitzsimons, 4 Mowat Ave., Toronto, Ont. Secretary, H. R. Roth, 57 Bloor St., W., Toronto, Ont.

Oregon: Organized, 1939. Headquarters, Portland, Ore. Meets, Thursday after First Tuesday. President, F. F. Urban, 6726 S. W. Burlingame Ave., Portland. Secretary, M. W. Pysher, 934 S. E. Sixth Ave., Portland 14.

Pacific Northwest: Organized 1928. Headquarters, Seattle, Wash. Meets, Second Tuesday, President, D. C. Griffin, 717 Lloyd Bldg., Seattle 1. Secretary, C. W. Finn, Boeing Aircraft Co., Plant No. 2.

Philadelphia: Organized, 1916. Headquarters, Philadelphia, Pa. Meets, Second Thursday. President, R. D. Touton, Ninth & Columbia Ave., Philadelphia. Secretary, F. H. Buzzard, 624 Wood Lane, Haddonfield, N. J.

Pittsburgh: Organized, 1919. Headquarters, Pittsburgh, Pa. Meets, Second Monday. President, L. S. Maehling, 778 Country Club Dr., Pittsburgh 16. Secretary, E. H. Riesmeyer, Jr., 231-33 Water St., Pittsburgh 22.

Rocky Mountain: Organized, 1944. Headquarters, Denver, Colo. Meets, First Wednesday. President, J. H. McCabe, 1730 Glenarm St., Denver. Secretary, F. L. Adams, P. O. Box 840, Denver 1.

St. Louis: Organized, 1918. Headquarters, St. Louis, Mo. Meets, First Tuesday. President, W. J. Oonk, 4548 Red Bud Ave., St. Louis 15. Secretary, W. A. Russell, 1948 N. Ninth St., St. Louis.

South Texas: Organized, 1938. Headquarters, Houston, Tex. Meets, Third Friday. President, J. A. Walsh, P. O. Box 1773, Houston. Secretary, D. M. Mills, Gray & Crawford, Houston 3.

Southern California: Organized, 1930. Headquarters, Los Angeles, Calif. Meets, Second Wednesday. President, Maron Kennedy, 5051 Santa Fe Ave., Los Angeles 11. Secretary, R. A. Lowe, 3744 Potomac Ave., Los Angeles 16.

Utah: Organized, 1944. Headquarters, Salt Lake City, Utah. Meets, First Wednesday. President, H. G. Richardson, 1433 Harvard Ave., Salt Lake City. Secretary, E. V. Gritton, 2470 S. 15th East St., Salt Lake City.

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Western Michigan: Organized, 1931. Headquarters, Grand Rapids, Mich. Meets, Second Monday. President, H. J. Metzger, 137 E. Water St., Kalamazoo. Secretary, H. W. Wolters, 820 Staples Ave., N. W., Kalamazoo 54.

Western New York: Organized, 1919, Headquarters, Buffalo, N. Y. Meets, Second Monday. President, F. A. Moesel, 31 Main St., Buffalo 3. Secretary, J. S. Meyer, 38 Crescent Ave., Buffalo 14.

Wisconsin: Organized, 1922. Headquarters, Milwaukee, Wis. Meets, Third Monday. President, O. A. Trostel, Route No. 2, Thiensville. Secretary, J. R. Vernon, 507 E. Michigan St., Milwaukee 2.

Messages from Members in Service

The Officers of the Society have received some interesting correspondence from members in Service and some extracts from their letters are quoted for the information of their fellow members.

From J. R. Peterson, Sgt., Co. C, 1st Bn., Hq. Sv. Sp. A.F.P.A.C.—I have received many issues of the magazine Heating, Piping & Air Conditioning which I enjoy reading, and I find them a great help in maintaining contact with the heating field.

Many thanks for your excellent service and regard for those in the Armed Forces.

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From Barney Menditch, Cpl., Service Co. P.B.S. (V Mail)—Please change my mailing address. It may be of interest for you to know that a number of ice cream plants have been set up in Italy by the Army, and we are now setting up a large ice plant here in Leghorn.

•

From Richard F. Meates, Sgt., Hq. Co. Q.M. Sec., Base M, APO 70—To date I have served with the Army overseas for over three years as First Sgt. of a Refrigeration Company in the South Pacific area, most of the time in the Solomon Islands.

I am glad to accept your invitation to contribute an item for the Journal, and I hope that my fellow members in the Society will be interested in some of the experiences we have had with refrigeration in the Army.

•

From Henry Nottberg, Jr., Lt. (jg), CEC, USNR, 130th Naval Constr. Bn.—I just received the April 1945 issue of Heating, Piping & Air Conditioning, and was very pleased to get it even though a little late.

The delay, of course, can be overlooked in view of the fact that it travelled many thousands of miles to this back door of Tokyo.

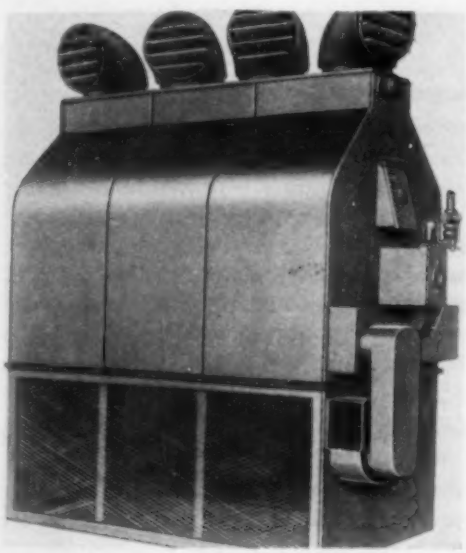
My work in the Navy has consisted of handling all of the mechanical construction on projects built by this battalion. Types of jobs include refrigeration, water purification plants, airfield water distribution systems, cooling tower designs and installations, and miscellaneous piping systems. It has all been very interesting thus far.

• EQUIPMENT DEVELOPMENTS •

For your convenience in obtaining more information about any of this equipment, see coupon on this page. Add the new products and companies listed here to your Directory Section which you received in your January 1945 Heating, Piping & Air Conditioning and thus keep your records of sources of supply up to date throughout the year. Single asterisk indicates equipment not listed in Directory Section; double asterisk equipment and manufacturer not listed.

Direct Fired Heaters

No. 2901**—Production of a new line of direct fired heaters for commercial and industrial applications has been announced by the Herbert H. Davis Co., 1616 S. 52nd St., Cicero, Ill. The heaters range in capacity from 75,000 to 2 million Btu per hr and are available for oil, gas, and coal. They are of all steel construction, self-contained, and are equipped with automatic control systems. According to the manufacturer, these units are adaptable either for air distribution direct through rotatable diffusers or through ducts.



Among the design features are the following: the unit is shipped in two sections, making possible unloading and placing without heavy crane facilities; filters may be applied without special transformation; independent V-belt driven induced draft fan; tubes may be cleaned while standing on the floor; and thermostatically controlled humidification.

A. E. Whitney has recently joined the company as vice-president and general sales manager.

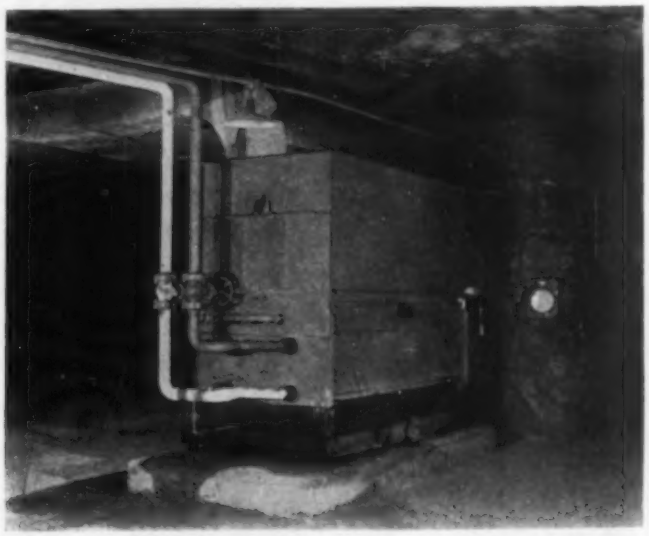
Maintenance Refractory

No. 2902**—"Zircoat-M," a zirconium silicate base refractory, has been announced by Basic Refractories, Inc., 845 Hanna Bldg., Cleveland, Ohio. According to the manufacturer, this refractory, when applied with a spray gun, sets up rapidly to form a hard, dense working surface that will withstand high furnace operating temperatures.

It is mixed with water for spraying and has been used as a protective coating on silicon carbide, fireclay, sillimanite, mullite, silica, and other acid type refractories, it is said. It is also recommended by the manufacturer for protecting boiler brickwork that is exposed to flame impingement and the corrosive action of clinker or fly ash.

Refrigerated Cave

No. 2903—The War Food Administration's refrigerator cave at Atchison, Kansas, is said to be the largest cold storage plant in the world, comprising about 9 million cu ft of refrigerated space. The natural cave temperature of about 55 F has been reduced to a few degrees above freezing by the installation of 48 fan coolers, manufactured by the Niagara Blower Co., 6 E. 45th St., New York 17, N. Y. Each handles 19,000 cfm



and is rated at 13½ tons refrigeration capacity based on the circulation of brine at a temperature of 20 F through the cooler coils.

Three compressors, each of 250 tons rating, furnish refrigeration for chilling the brine. The coolers are located at intervals throughout the cave and are furnished with short air ducts to provide uniform distribution of cold air. The total air handled is nearly a million cfm.

Heating, Piping & Air Conditioning, [9-45]
6 N. Michigan Ave., Chicago 2, Ill.

Please ask the manufacturers to send me more information about the equipment mentioned under the following reference numbers in Equipment Developments and Recent Trade Literature.

(*Circle each number in which you are interested*)

2901	2902	2903	2904	2905	2906	2907	2908	2909	2910
2911	2912	2913	2914	2915	2916	2917	2918	2919	2920
2921	2922	2923	5052	5053	5054	5055	5056	5057	5058
5059	5060	5061	5062	5063	5064	5065	5066	5067	

Name..... Title.....

Company .....

Address .....

City..... Zone..... State.....

Something *NEW* in Better Pipe Cutting

New Efficiency-Balanced RIDGID CUTTER

with fast-action, thin-blade cutter wheel

● The instant you pick up this new RIDGID pipe cutter, with its rugged new style malleable frame, you like the feel of it, the efficient balance—and it cuts pipe with the easy speed that feeling suggests. True clean cuts, almost without burr, the thin tool-steel blade wheel rolling right through with least effort. Make your next cutter a new RIDGID—ask your Supply House. We're doing our best to keep it supplied.

You'll like this No. 42 4-wheel cutter, too — fast quarter turn cutting.

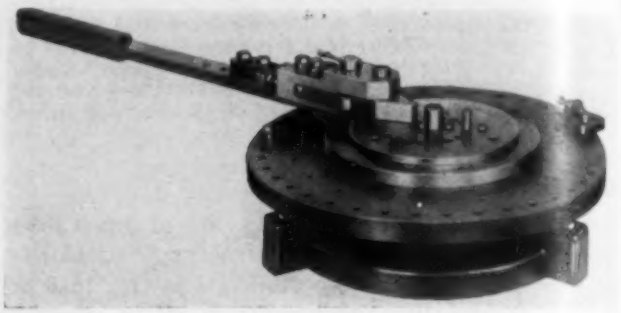
RIDGID

WORK-SAVER PIPE TOOLS

THE RIDGE TOOL COMPANY · ELYRIA, OHIO, U. S. A.

Bending Machine

No. 2904—"Di-Acro" benders have been redesigned and improved, according to the manufacturer, the O'Neil Irwin Mfg. Co., 316 Eighth Ave., S., Minneapolis 15, Minn. Operating friction has been greatly reduced by the installation of roller bearings, it is said, and another



feature of the new models is an instantly reversible lever control cam which allows the operator a choice of either right or left hand forming direction. The latter feature makes it possible to eliminate interference which may occur when several intricate shapes are formed successively in a single piece by simply reversing the forming direction of the machine.

Three-Purpose Welding Electrode

No. 2905—A new combination type welding electrode, "Airco No. 315," designed to produce horizontal fillet welds with flat or slightly concave profiles and concave fillets in the flat position, as well as satisfactory deep fillet and deep groove, has been announced by the Air Reduction Sales Co., 60 E. 42nd St., New York 17, N. Y. Usual applications include pressure vessels and their connections, heavy machine weldments, and structural assemblies such as trusses, built-up girders and connections.

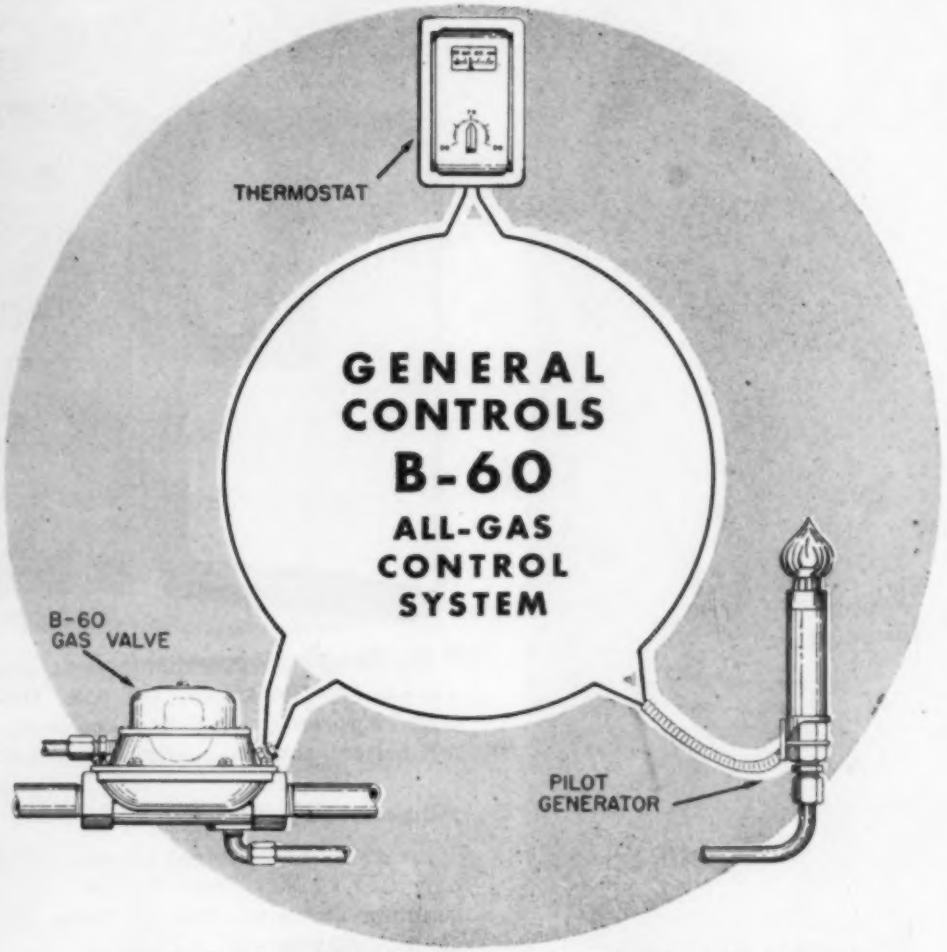
The electrode may be used with conventional technique, employing normal currents, under which conditions medium penetration is obtained. Deeper penetration is secured, however, when the deep fillet technique is used with the high currents recommended for this procedure.

Hot Water Meter

No. 2906—The "Propeloflo" meter, which has been used for metering water at ordinary temperatures, is now available for metering water at temperatures up to 250 F, according to the manufacturer, Builders-Providence, Inc., Div. of Builders Iron Foundry, 9 Codding St., Providence 1, R. I. Venturi design and all other features of this propeller type meter are retained.

Time Switch

No. 2907—"300 Series" time switches are now powered by the "Telechron" motor, according to the manufacturer, the Paragon Electric Co., 37 W. Van Buren St., Chicago 5, Ill. Among the operating features claimed for this type of motor are self lubrication by



A completely self-contained and self-operating system for automatic room temperature control, consisting of a T-80 Series Trimtherm Thermostat, a B-60 Gas Valve and a Pilot Generator. No outside current is required.

PILOT GENERATOR

The pilot generator flame bathes a series of thermocouples arranged in a cluster which produce the electrical current necessary to operate the control system. The generator also serves as the pilot for main burner ignition and as a positive safety shut-off. (When pilot flame is extinguished no current is generated, consequently the B-60 valve cannot open.)

T-80 TRIMTHERM

Scientifically correct in design, the Trimtherm not only "lives thermally in the room," but its graceful, vertical lines with chrome cover and natural ivory base are complimentary to any room color scheme.

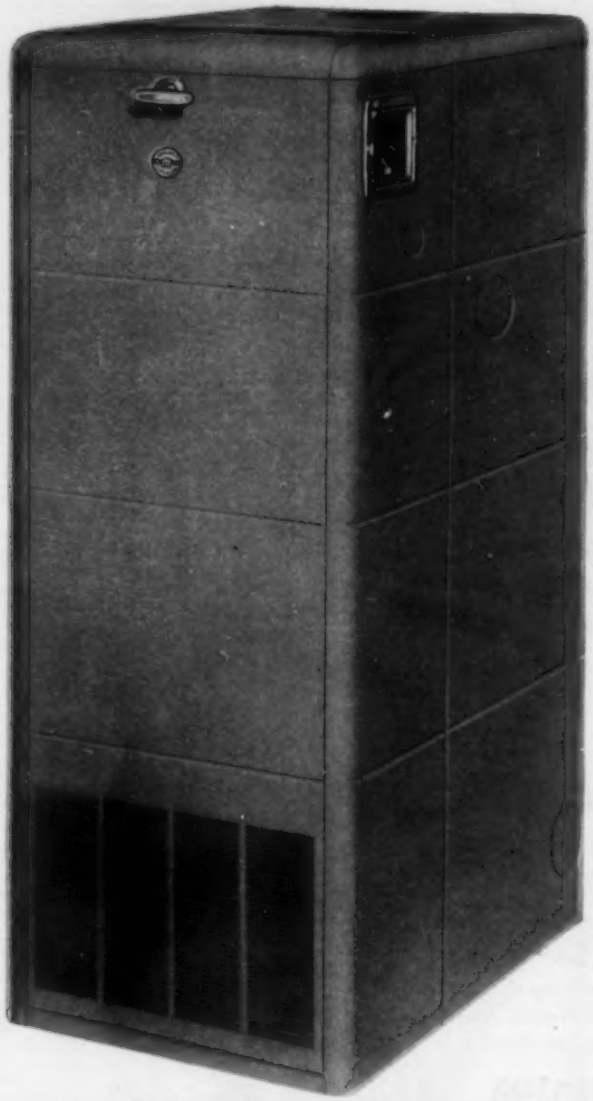
B-60 GAS VALVE

The B-60 Control is a pilot operated diaphragm type valve and is silent in operation. The integral three way pilot valve actuated by the current of the Pilot Generator regulates the main valve to the open and closed position at the demand of the room Thermostat.

For further information, contact your nearest General Controls factory branch or distributor, or write for Catalog 52-B and the B-60 Service and Instruction Manual FI-101.

GENERAL CONTROLS
801 ALLEN AVENUE **GLENDALE 1, CALIF.**

FACTORY BRANCHES: ATLANTA • BOSTON • CHICAGO • CLEVELAND • DALLAS • DENVER • DETROIT • HOUSTON • KANSAS CITY
NEW YORK • PHILADELPHIA • PITTSBURGH • SAN FRANCISCO • SEATTLE • *DISTRIBUTORS IN PRINCIPAL CITIES*



Again in the new Type 10

Mueller Climatrol
REG. U. S. PAT. OFF.
Gas Boiler

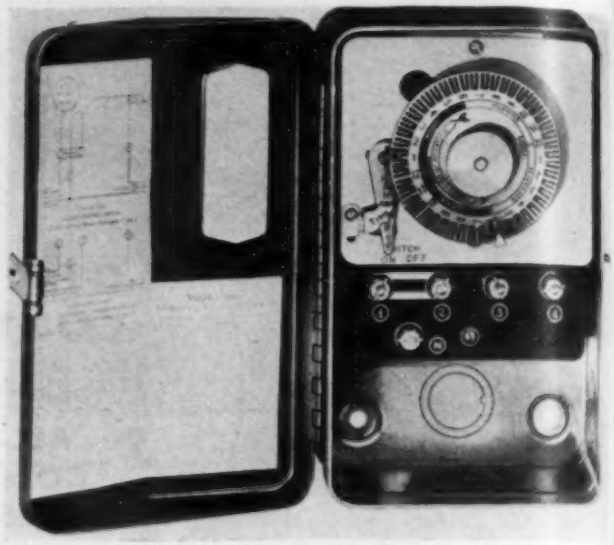
— the Mueller name stands for advanced design assuring better performance . . .

Engineered up to the minute — to set new standards of gas-heating results and satisfaction — the latest Mueller Climatrol gas boiler incorporates an entirely new burner design which is extremely quiet in operation. The exterior is restyled for smart, modern appearance. Many other new features help it live up to Mueller's 88-year record of heating progress. Suitable for residences and smaller commercial installations. Series also includes Type 20 for larger jobs. Feature the Climatrol Type 10 for profitable, successful installations. Write for "Gas Boiler Facts and Figures" bulletin. . . . *L. J. Mueller Furnace Co., 2007 W. Oklahoma Avenue, Milwaukee 7, Wisconsin.*

E-18

Climatrol
REG. U. S. PAT. OFF.

a capillary oiling system, quick self starting at full rated load, fully sealed gear reduction to exclude dust and dirt, and low power consumption.



The switch itself is lightweight, compact, and has a capacity of 3000 watts per pole. Other features include accessible terminals, knockouts on both back and bottom, and two bearing construction.

Industrial Hose Coupling

No. 2908—Lightweight aluminum construction with only two moving parts features the industrial hose coupling which has recently been announced by the E. B. Wiggins Oil Tool Co., Inc., 3424 E. Olympic Blvd., Los Angeles 23, Calif. It is built to withstand 600 psi and brings the full water pressure to the end of the nozzle, says the manufacturer.

The unit includes a threaded end section that applies on a standard threaded faucet and a ring equipped section for application in the end of a length of hose. The ring is pulled back by a spring, and moves axially over a set of hinged dogs. Moving the ring back against the spring permits the dogs to swing open and clear a holding ring integral on the shank of the section applying on the faucet. Releasing the ring after the two coupling sections have been brought together closes the dogs inward to grip the ring and hold the assembly together. The shank on the faucet section rides inside a rubber gasket in the ring section and this is said to prevent leakage at normal hose pressure. Sizes available are $\frac{5}{8}$ and $\frac{3}{4}$ in. standard.

It's Good Business to Conserve Fuel!

GASKET DATA

FURNISHED BY PRODUCTS RESEARCH CO.
634 S. WESTERN AVE.
LOS ANGELES 5, CALIF.

THREE years ago, chromate gasketing was specially developed for the U. S. Navy. And for three years this type of gasketing has withstood the terrific vibrations of all types of ships in action, due to its tremendous cushioning effect.

CHROME LOCK, this new type of gasketing of felt base, is impregnated with a chromate pigmented compound which renders it flame and corrosion-resistant. CHROME LOCK holds up under pressure of 500 lbs. or more per square inch at normal temperatures. It is not affected by fuels and will retain its pliability under locked-in pressure. The storage life of CHROME LOCK is far in excess of necessity. CHROME LOCK is now offered for industrial uses. *A free sample has been reserved for you. Send for it today.*

ADVANTAGES

1. Flame-resistant
2. Warp-proof
3. Rust-inhibiting Qualities
4. Longer Life
5. Anti-wicking
6. Fuel-resistant
7. Adhesive to Metal
8. Anti-squeak
9. Non-oxidizing
10. Non-hydroscopic
11. Easy to Handle
12. Less Expensive

USES

1. Air Conditioning
2. Heating
3. Refrigeration
4. Anti-squeak on Non-removable Fittings
5. All Piping
6. Joint Seals For:
   - Diesel Oil
   - Fuel Oil
   - Gasoline
   - Mild Acids
   - Water (Fresh and Salt)
7. Water-tight and Air-tight Connections to Structures
8. Flange to Flange Joints

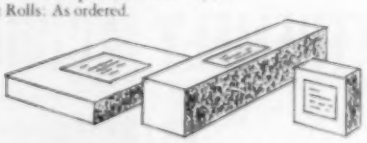
TYPES and FORMS

Sheets *Rolls* *Slit Rolls*

Sheets: 1/16" and 1/8" thick – 36" x 48".
Rolls: 1/16" thick – 36" wide – 200 sq. ft. to roll.
1/8" thick – 36" wide – 100 sq. ft. to roll.
Slit Rolls: Sold by linear foot. Rolls approximately 50 linear feet in following widths: 1", 1¼", 1½", 2", 3", and other sizes on special order.

PACKAGING and SHIPPING

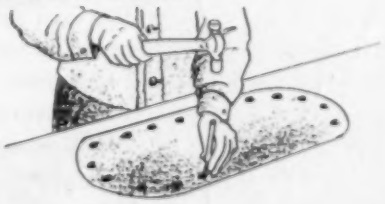
Sheets: In heavy cartons, 20 sheets of 36" x 48" – 1/16"
10 sheets of 36" x 48" – 1/8"
Rolls: 200 sq. ft. 36" wide – 1/16"
100 sq. ft. 36" wide – 1/8"
Slit Rolls: As ordered.



SPECIAL GASKETS

Special shapes or sizes can be cut economically and advantageously by any commercial gasket cutting company.

EASY TO CUT



A FEW USERS of Chrome Lock

Bethlehem Steel Company
California Shipbuilding Corporation
Consolidated Steel Corporation
Kaiser Company, Inc.
Permanente Metals Corporation
Todd Shipyards Corporation
Western Pipe & Steel Co.
Todd Pacific Shipyards, Inc.

SALES OFFICES in following Cities:

New York *Portland*
Houston *San Francisco*
Seattle *Los Angeles*

Chrome Lock Gasketing

Chrome Lock

PRODUCTS RESEARCH CO.
634 S. WESTERN AVE. LOS ANGELES 5, CALIF.

PRODUCTS RESEARCH CO.
634 S. Western Ave., Los Angeles 5, Calif.

Please send me FREE sample of Chrome Lock Gasketing

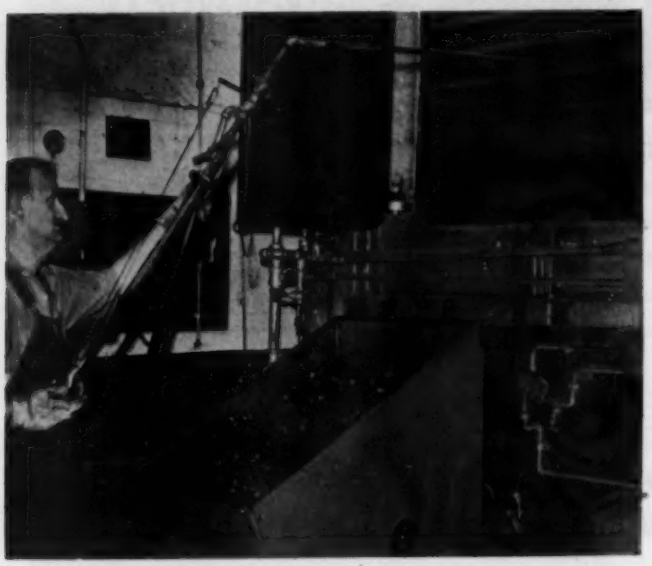
Name _____

Address _____

City _____ Zone _____ State _____

Boiler Tube Cleaner

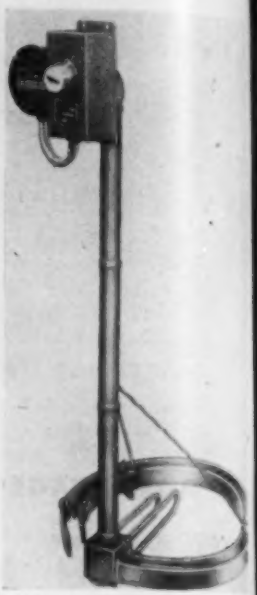
No. 2909**—The device shown quickly cleans boiler tubes, according to the educational committee of the Compressed Air Institute, Room 1111, Terminal Tower,



Cleveland, Ohio. It consists of a shovel handle attached to a pipe. At the end of the pipe is a metal disc which dislodges soot in the tubes. Compressed air is introduced into the pipe from a metal hose at the worker's left; the air valve is controlled by the chain in the worker's hand. After the soot is dislodged, air is released to blow it out.

Portable Drum Immersion Heater

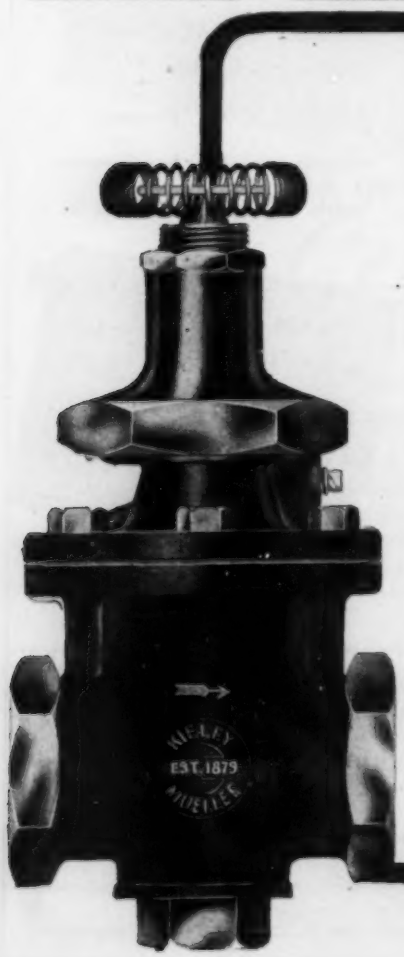
No. 2910—A portable drum immersion heater designed for melting solid oil, greases, and similar compounds has been announced by the Edwin L. Wiegand Co., 7610 Thomas Blvd., Pittsburgh 8, Pa. Known as type "BLC," this "Chromalox" unit is available for 115 or 230 volt single phase current in ratings up to 4400 watts.



The construction features include the use of steel braces welded to the steel riser through which the electrical connections are brought out to a standard conduit box. The heater can be controlled by means of a three heat switch or thermostat mounted directly on the terminal box.

Axial Flow Blower

No. 2911—The "Vaneaxial" axial flow blower for high pressure air movement has been announced by the Hartzell Propeller Fan Co., P. O. Box 909, Roosevelt Ave., Piqua, Ohio. The entrance bell and noses



EXTREMELY ACCURATE REGULATION

. . . EXTREMELY COMPACT IN SIZE

A fraction turn of the handwheel—and you can control *exactly* the pressure of steam passing through this very compact K & M Reducing Valve. Model 481 is widely used for difficult reduction service in industrial processes—and as a primary valve in double reduction installations. Self-contained . . . made in bronze . . . available in valve sizes of ½" to 2"—with 5⅜" the maximum overall measurement, face to face! Yet it accurately controls inlet pressures up to 250 lbs. . . . maintaining constant reduced pressures of 2 lbs. to 80% of the inlet. If you have a tough pressure reduction problem, perhaps K & M #481 is the answer. Our Engineering Department invites your inquiries.

Write for Catalog 66-C

KIELEY & MUELLER, INC.

MANUFACTURERS OF PRESSURE AND LEVEL CONTROLS

2015 43rd ST., NORTH BERGEN, N. J.

Awarded our employees for outstanding production achievement.

MORE STEAM at LOWER COST

LOOKING FOR a way to trim your fuel costs and boiler room operating expenses? Then you'll surely be interested in every feature of the Æ Perfect Spread Stoker—from its "streamlining with a purpose" to its "crossfiring" principle of combustion.

This modern, dependable stoker efficiently burns any kind or grade of solid fuel, wet or dry, including by-products and plant refuse. Maximum heat from every pound of fuel means more steam at very worthwhile savings. In operation, the stoker is extremely clean and quiet, answering steam demands instantly. It puts an end to many wasteful boiler room practices.

You may find in these and other important advantages the way to cut *your* fuel bills and boost operating efficiency. Write today for the new Æ Perfect Spread Stoker bulletin.

Overthrow ROTOR SPREADS PERFECT FUEL BED

Over-the-rotor feed covers the entire grate area with a "Perfect" fuel bed and causes less wear on the rotor and housing. The uniquely designed and balanced Æ rotor spreads fuel perfectly, the fines burning in suspension and the heavier particles dropping to the grate for thorough combustion. This rotor is an exclusive feature not found in any other stoker.

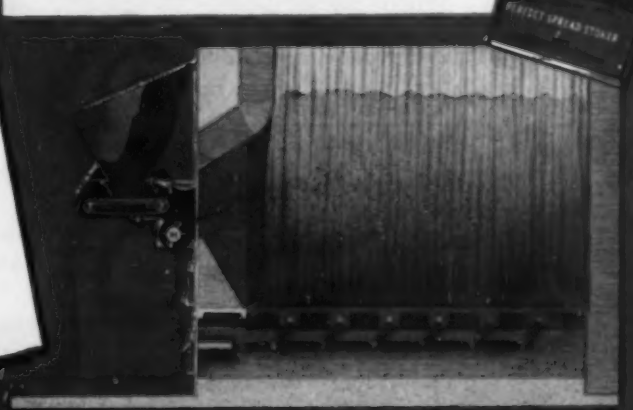
Cooperates with the "National Fuel Efficiency Program" of the U. S. Bureau of Mines.

If Your Steam Requirements Call for 175 H. P. up to 200,000 lbs. per hour—

YOU NEED THIS BULLETIN

Write us. 2420 Aramingo Ave., Philadelphia 25, Pa.

Æ PERFECT SPREAD STOKER



AMERICAN ENGINEERING COMPANY

Subsidiaries: COCHRANE CORPORATION, FARADAY ELECTRIC CORPORATION

PHILADELPHIA 25, PENNSYLVANIA

THE joyous RELIEF of a nation has been expressed. But INEXPRESSIBLE feelings go on—the nation's grief for those who paid with their lives—the sorrow for their families—untold sympathy for all who made the REAL sacrifices. To them, a nation pays endless tribute . . . tries but cannot adequately express its undying gratitude. It is sensed that the only way lies in "winning of the peace" for which they paid such a price. As full attention turned to the new kinds of problems ahead, well-laid plans of the Schaible Company went into action quickly. And the first two items in production are already rolling in volume.

RECONVERSION POLICY

Our full line will be W-I-D-E . . . new models and new items . . . *heating* field *as well as plumbing*. But we plan to start production of each item only as it could be maintained on a reasonable delivery basis and be a quality product. This means devoting our full capacity to just a few items at first, and adding others gradually. That is the way we can do everyone the most good so long as scarcities remain—by producing the *most* volume possible as *quickly* as possible. And that is best served by *huge* production of fewer items, instead of *smaller* production of more items (with bad deliveries).

FOR THE PRESENT

First, we plan to produce faucets and strainers. A Stainless-steel Basket Strainer and Deck-type Sink Faucet (less spray) are in production now. Next to be started will be a Flat Strainer, a Deck-faucet with spray, and perhaps a Lavatory Faucet. Those items are on an allotment plan through our Representatives, who each have a limited quota for the first phase of reconversion, representing our first few months' output.

LATER RECONVERSION

Beyond the above "first phase", the exact timing of subsequent developments cannot yet be predicted accurately. So instead of guessing now, each new development will be announced as it occurs—as our ability to serve improves . . . and as each new item is added to production.

Again we want to thank our customers and other friends for their continued understanding and patience—until that glorious time when patience and special understanding will no longer be necessary.

Schaible

The Schaible Company

CINCINNATI 4, OHIO

MAKER OF QUALITY PRODUCTS SOLD
FOR USE BY LEADING WHOLESALERS EVERYWHERE

(on each end of the unit) are of spun 14 ga steel. The wheel is cast in one piece from aluminum alloy. The vanes are welded to both inner and outer shells and thus form a rigid support for the motor housing, motor, and wheel. The motor itself is totally enclosed, ball bearing, with provision for lubrication from outside the duct.

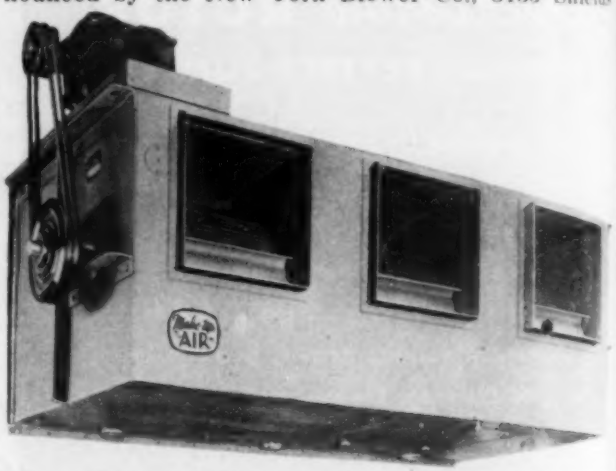
Construction features and design of this unit are said to provide high efficiency in air movement as well as easy installation and quiet operation.

Stoker Company Takes Over Heating Controls Firm

No. 2912—The Iron Fireman Mfg. Co., 3085 W. 106th St., Cleveland 11, Ohio, has taken over the plant and business of the L. R. Teeple Co., which has concentrated its production on control instruments for the stoker company since its beginning in 1923. The change in operation became effective August 1. The plant is now known as the heating control division of the Iron Fireman Mfg. Co.

Blower Unit

No. 2913—Delivering warmed, filtered outside air to industrial spaces to replace exhausted air is the purpose of the "Make-up Air" unit recently announced by the New York Blower Co., 3155 Shields



Ave., Chicago 16, Ill. According to the manufacturer, the increasing use of exhaust fans in modern industry depletes the air supply within the building, a condition that may be corrected by replacing the air from the outside. These units are made in four sizes from 5,000 to 20,000 cfm, and are said to prevent drafts and uncontrolled infiltration.

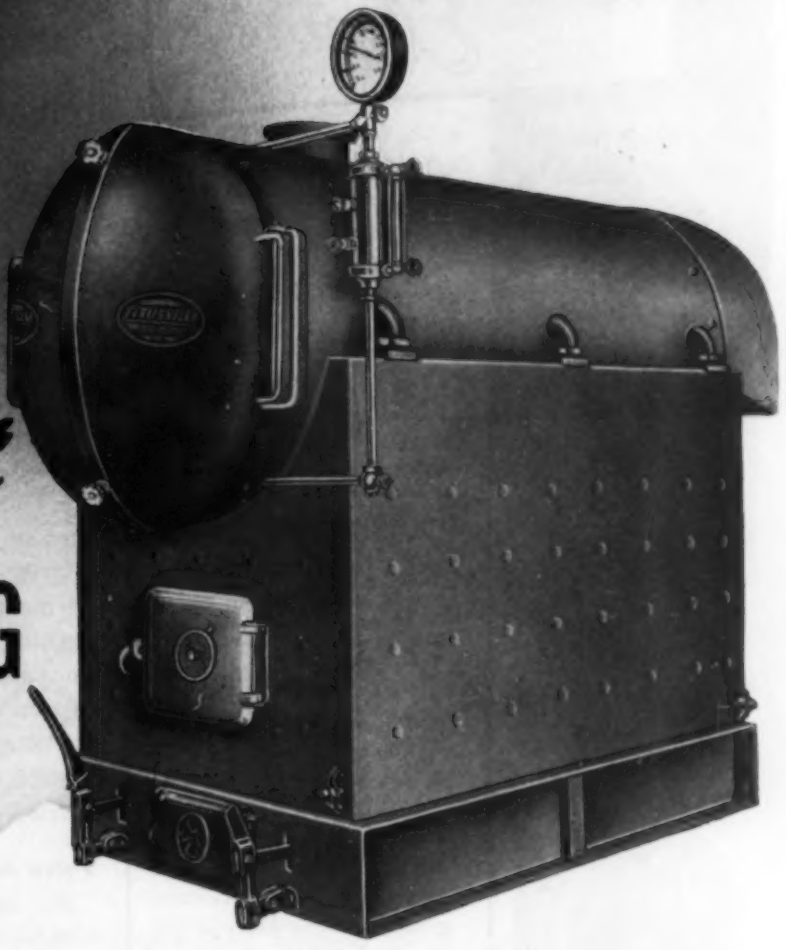
V-belt Sheave

No. 2914—As a means of quickly mounting and demounting V-belt sheaves, the Dodge Mfg. Corp., 500 S. Union St., Mishawaka, Ind., has announced the "Taperlock" V-belt sheave. In installation, the sheave and bushing assembly are slipped onto the shaft, after which two or three locking screws are tightened, depending on the size of the sheave. The screws are in threaded engagement with the sheave hub and free in the bushing groove. As the screws are tightened they push against the tapered bushing, forcing it into the tapered bored hub. This causes the bushing to contract and wedge between the hub and shaft on which it is installed.

To remove the sheave from the shaft the lock-

From COLD Boiler to STEAM in less than 30 minutes

TITUSVILLE *Compact* STEEL HEATING BOILERS



"The proof of the pudding is in the eating"—and by the same token, the true test of any boiler is in its performance when operating.

Titusville Compact Boilers prove their steaming qualities by generating steam from a cold boiler in *less than 30 minutes* —proof positive of a well designed and properly proportioned boiler. Titusville Compact Boilers are destined to set new records for saving fuel—giving greater operational satisfaction and longer life. New bulletin—just off the press is yours for the asking.

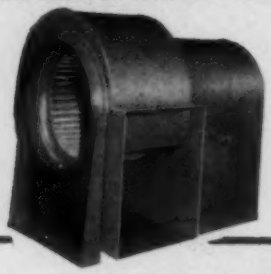
TITUSVILLE
IRON WORKS CO
TITUSVILLE, PA

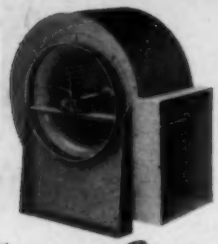
Division of
STRUTHERS WELLS CORPORATION
TITUSVILLE, PENNSYLVANIA
Plants at Titusville, Pa. and Warren, Pa.
Offices in Principal Cities

MAKE YOUR VENTILATING JOBS Peerless Electric

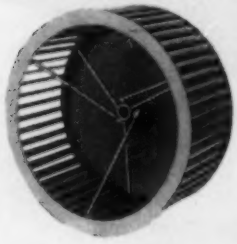
and get the benefits of 50 years' experience in building quality motors and electrical apparatus

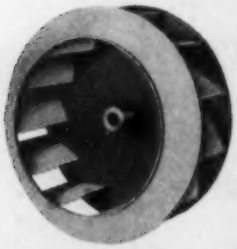
- 26 BELT DRIVE SIZES
- 12 DIRECT DRIVE SIZES





Peerless Electric
VENTILATING BLOWERS
SIZES 12" to 48"
Shown here in Arrangement 3





Peerless Electric
BLOWER WHEELS
Forward curve and backward curve blower wheels full welded construction carefully balanced for smooth, quiet rotation.

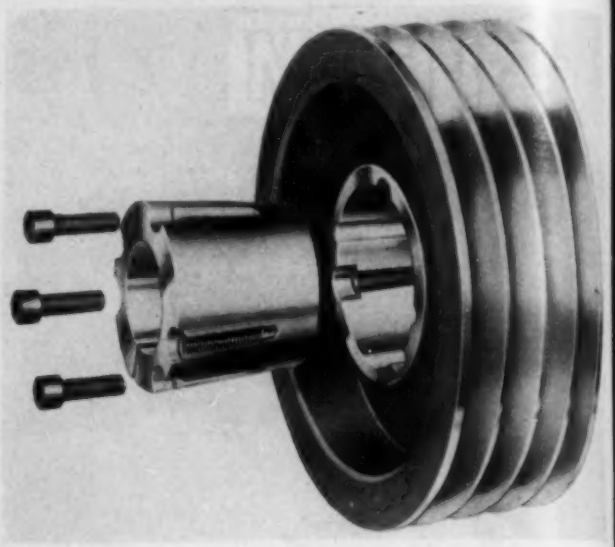
Peerless Electric
VENTILATING SETS
Belt drive units are powered with ½ to 7½ h.p. motors; direct drive units ½ to 2 h.p. motors. All units supplied with or without weatherproof hood covers for drive mechanism.

NO matter what your needs—for small jobs or large jobs—it will pay you to make Peerless your headquarters for ventilating equipment. More than 50 years of experience have given Peerless Electric the "know-how" that enters into the design and manufacture of Peerless Electric fans, blowers and ventilating equipment, entirely in our own modern plant. Peerless Electric is small enough to study your needs and special applications intimately—large enough to supply your complete requirements.

Write us for details on any standard Peerless Electric ventilating equipment, or tell us your special problems.

THE Peerless ELECTRIC COMPANY
WARREN, OHIO
Established 1893

To remove the sheave from the shaft the locking screws are removed and one or two of them are inserted in jack screw holes, which are partially in the bushing and partially in the hub. The portion of the

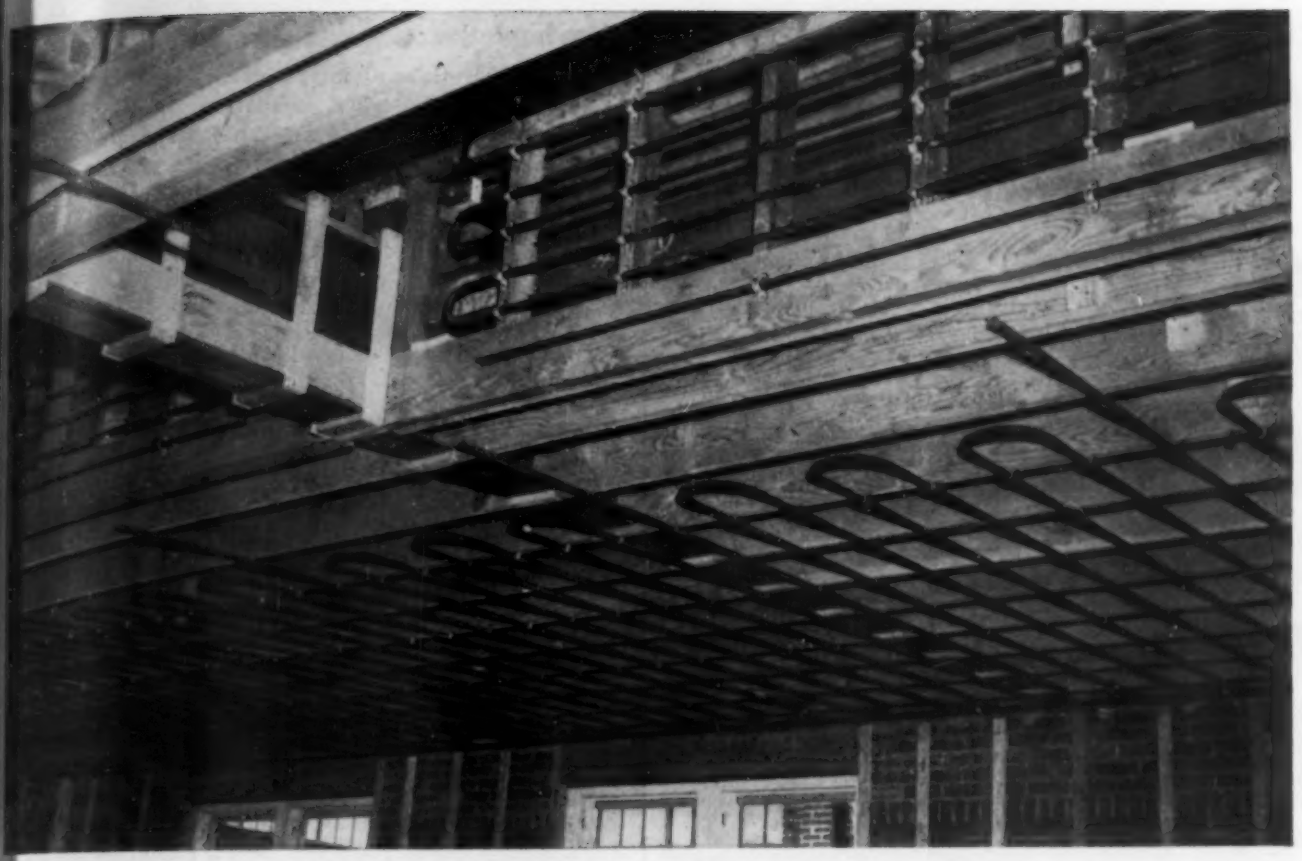


jack screw hole in the bushing is threaded and that in the hub portion is unthreaded. As the screws are tightened, the bushing is de-wedged and the sheave is free for removal from the shaft. According to the manufacturer, the advantages of this construction are that it provides a mounting of minimum dimensions for accommodation of the screws and their connection with hub and bushing; and that it permits the use of a flangeless bushing and eliminates any extension of either hub or bushing or any collars or protruding parts.

Valve Actuator

No. 2915**—A hydraulically operated valve actuator to cover a wide range of sizes and applications has been announced by the Pacific Division of the Bendix Aviation Corp., North Hollywood 34, Calif. Known as the "Hydrodyne," this unit incorporates a simple hydraulic system which produces force in a straight line through a hydraulic cylinder to open and close the valve.

According to the manufacturer, as the valve seats the hydraulic pressure continues to build up, sealing the gate against leakage. Pressure is then locked in the cylinder and only the reverse action will unlock it. For emergency, the unit is provided with a completely independent hydraulic system which uses a hand pump. These actuators are available for use on valves from 4 to 36 in., and auxiliary regulating and indicating equipment can be furnished for step-by-step position control, infinite position control, and on-and-off control for virtually any type of application, says the manufacturer.



HERE IS THE PIPE FOR *Radiant Heating*

Its strength, high ductility and easy weldability make Ammonoduct the ideal pipe for radiant-heating installations.

The pipe coils that radiant heating calls for are made quickly and at little cost with Ammonoduct, because Ammonoduct *bends cold!* You can bend it to very close centers, either in your shop or on the job, without the bother and expense of heating. You'll like the way Ammonoduct welds, too. Even a welder of little experience can make welds that are sound, and free of pinhole leaks.

Another advantage: Ammonoduct's coefficient of expansion approximates that of concrete or plaster, thus making a certainty of a tight, permanent bond between the pipe itself and the concrete or plaster in floors or ceilings.

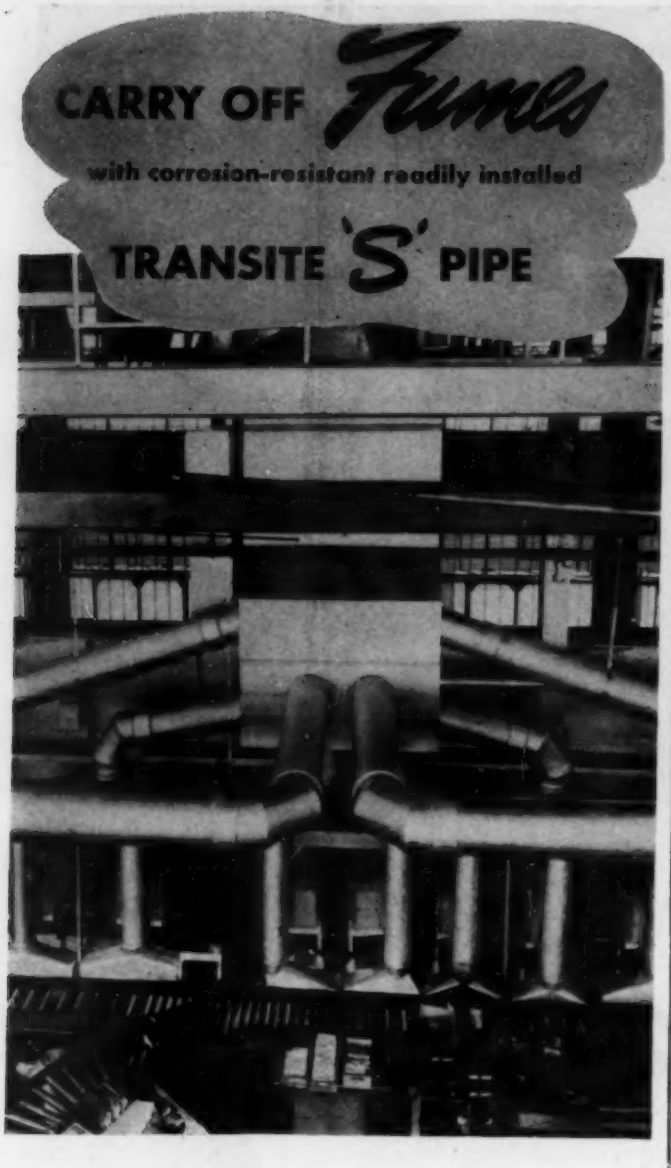
Ammonoduct is made by the continuous-weld process from a special grade of low-carbon open-hearth steel developed by Bethlehem metallurgists. That's what gives Ammonoduct its remarkable strength and ductility, making it so easy to work and to weld.

With all its advantages of cold-bending, weldability, easy cutting and threading, Ammonoduct costs no more than regular steel pipe. Your Bethlehem pipe distributor can supply you with Ammonoduct in uniform 21-foot lengths, plus or minus 1 inch, standard weight or extra strong.

AMMONODUCT

EASY WORKING . . . BENDS COLD

BETHLEHEM STEEL



● Here's a ready solution to most venting problems . . . including the problem of high installation and maintenance costs!

Use easy-to-handle Corrosion-resistant Transite 'S' Pipe for vents, ducts and stacks

Made of asbestos fiber and cement, Transite 'S' Pipe gives effective and economical service in venting most fumes, vapors, dusts, gases, etc. in industrial operations. It is highly weather-resistant . . . cannot rust.

In addition to being strong and durable, Transite 'S' Pipe has a smooth interior surface and relatively low-heat conductivity.

J-M Transite 'S' Pipe is made in 19 sizes . . . 2″ to 7″ diameters in 10′ lengths, 8″ to 36″ diameters in 13′ lengths. A complete line of fittings is available in the many sizes and shapes required for complex venting installations.

To obtain complete information, write today for data sheets DS Series 336. Address Johns-Manville, 22 East 40th Street, New York 16, New York.

JM PRODUCTS

TRANSITE 'S' PIPE

Johns-Manville

Glass Insulation

No. 2916**—Several improvements have been made in the new cellular glass insulation, "Foamglas," according to the manufacturer, the Pittsburgh Corning Corp., 632 Duquesne Way, Pittsburgh, Pa. One change increases the number of cells per cu ft from 5 million to 10 million, thus providing additional thermal protection. The *K* value (conductivity) of the original product was as follows:

K (conductivity at 50 F—0.45 Btu per hr per sq ft per F per in.

K (conductivity at 300 F)—0.70 Btu per hr per sq ft per F per in.

Values for the improved product are:

K (conductivity at 50 F)—0.40 Btu per hr per sq ft per F per in.

K (conductivity at 300 F)—0.55 Btu per hr per sq ft per F per in.

The present product is brown instead of black, as formerly.

This insulation is composed of prepared glass, cellulated under intense heat, and is said to be fireproof, waterproof, and verminproof.

Air Conditioning and Refrigeration

No. 2917—A large part of the heavy ordnance manufacturing facilities of its Holyoke, Mass., plant will be turned to the production of air conditioning and refrigeration machinery, according to the Worthington Pump & Machinery Corp., Harrison, N. J. Facilities for such operation have already been moved to Holyoke from the Harrison plant.

Engineers are concluding designs for a new line of "Freon-12" refrigerating compressors. A line of air handling equipment, including air conditioning units, shower condensers, product coolers, and evaporative coolers, will also be produced. Sales headquarters will locate in Holyoke, while heavy industrial equipment will continue to be made in Harrison.

Air Conditioned Trolley Coach

No. 2918—A trolley coach which is under construction at Worcester, Mass., is being completely air conditioned by the Carrier Corp., 302 S. Geddes St., Syracuse, N. Y. The coach is to be delivered soon to the Georgia Power Co. for experimental use in Atlanta.

The system consists of two air conditioning units and one "Freon" compressor. The compressor is driven by a 600 volt d-c motor, which will receive current from the trolley system. Two separate air cooled condensers are used, each provided with fan and motor. Cooling capacity control is automatic. The driver can use the fans of the units to provide ventilation without the use of the refrigeration system. The units are mounted over the roof of the coach and are held by steel framing which carries the load to the side walls or posts. Cork pads isolate the units from the frame and there is no direct contact with the roof at any point. This air conditioning equipment is said to have a cooling and dehumidifying capacity equal to that used on the latest design railway cars.

Plant Expansion

No. 2919—The Marlo Coil Co., 6135 Manchester Ave., St. Louis 10, Mo., recently received WPB authori-

Ducts deliver cold without waste when insulated this way...

Air-conditioning duct in Gimbel Bros., Philadelphia, before finish was applied. Note how the Armstrong's Corkboard Insulation can be cut to conform exactly to the irregular contours.

It's quick and easy to apply Armstrong's Corkboard to ducts, using cement and metal bands.

LOW-TEMPERATURE conditioned air is accurately controlled and delivered with little possibility of heat absorption, when ducts and equipment are insulated with Armstrong's Corkboard. This lightweight insulation improves both thermal and operating efficiency of the system.

●Condensation is prevented, too, and there is no drip to cause structural damage or equipment failure. The maintenance problems that condensation can create are eliminated.

●Hundreds of installations have proved the value of this insulation. For moderate temperature differences and short ducts, air-conditioning engineers frequently recommend 1-inch thick corkboard on supply ducts, leaving return ducts bare. For heavy duty on long ducts or on fans and dehumidifiers, 1½" or 2" corkboard is used, with 1" on return ducts.

●Armstrong's Corkboard Insulation is applied either with hot asphalt or with specially prepared adhesives and is additionally supported with metal bands or copper-clad wire ties with metal corner protection. It may be finished with hard plaster finishes, asphalt emulsions, or emulsion and painted canvas.

●Armstrong's 40 years' experience in the low-temperature field is at your service in planning the insulation of new or unusual applications of air conditioning. Armstrong's Contract Service will follow through every detail of your installation to assure a satisfactory job. For information, write to Armstrong Cork Company, Building Materials Division, 4409 Concord Street, Lancaster, Pennsylvania.

ARMSTRONG'S INDUSTRIAL INSULATION

Complete Contract Service
For All Temperatures

From 300° Below Zero
To 2600° Fahrenheit

New Faso Protector Ends Drill Breakage!

NOW YOU CAN drill faster—*and not worry about breakage!* The new Faso split-shank drill protector & stop protects your drill at the weakest point. And it lets you set your drill for any desired depth.

The Faso drill protector & stop, now made by Hartwell, is available in selected sizes from 50 through F. Sizes 50 through 10 are held to ¼" outside diameter to fit standard drill chucks. Larger sizes are held to ⅜" outside diameter.

Hartwell also manufactures extension chucks in the above range of sizes, together with rod lengths of 6" and 11".

ASK YOUR JOBBER about the new Hartwell-made Faso line of drill protectors & stops, extension and angle chucks.

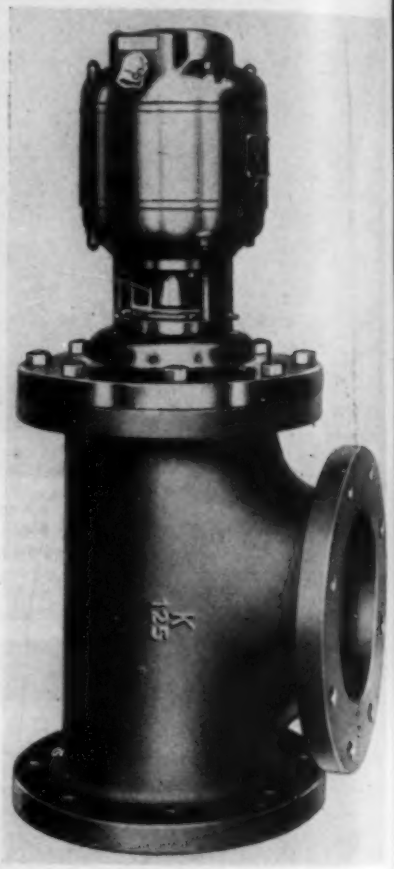
Single source for 779 production parts and tools

HARTWELL
ENGINEERING COMPANY
Designers • Manufacturers • Distributors
3417 Crenshaw Boulevard, Los Angeles 16, California
Dallas, Texas • Kansas City, Kansas

zation for new building and plant facilities, to add 14,000 sq ft to the present 24,000 sq ft plant floor area. Construction has already been started and when completed the rearranged plant will provide augmented production capacity for heat transfer equipment; evaporative coolers for diesel engines, transformer, cutting, and quenching oils; and air conditioning, industrial, and commercial refrigeration equipment.

Circulating Pumps

No. 2920**—"Axiaflo" circulators, designed for handling a large volume of liquid at low heads with minimum power requirements, have recently been announced by the Ruthman Machinery Co., 1810 Reading Rd., Cincinnati 2, Ohio. These pump units are equipped with ball bearing, totally enclosed, dynamically balanced motors.



The sizes available are 4 in. with a ¼ hp motor and 6 in. with ½ hp motor. Discharge capacities are 280, 700, 950, and 1200 gpm. These units have been used successfully to handle brine as well as other liquids, says the manufacturer.

Greenhouse Heating Controls

No. 2921—Most of the major studios in Hollywood operate their own greenhouses where they keep many exotic plants and ferns used on motion picture sets. On the Warner Brothers' lot a group of five greenhouses is heated from a central boiler operating at a temperature of 160 F. By placing the pump at the return end the water cannot recirculate without first passing through the boiler.

Each greenhouse has individual zone control. In each zone a thermostat is set for the desired temperature. When the temperature drops below the desired setting the thermostat circuit closes and activates a mercury relay, which in turn makes the contact to a "Hydramotor" valve (manufactured by General Controls, 801 Allen Ave., Glendale, Calif.) and at the same time to the circulating pump. As the pump starts, the valve opens, permitting the hot water to circulate. These slow opening valves insure tight shutoff for high operating pressures, says the manufacturer.

AVAILABLE WITHOUT PRIORITY !

Only ILG Unit Heaters Have Self-Cooled Motors That Never "Slow-Roast"

Now you can specify ILG Unit Heaters for *all* types of applications! These quiet, powerful, efficient, money-saving units have stood up under the grind of continuous 3-shift operation in war plants—are now ready to heat the "Vital Zone" wherever people work, shop or play. Popular sizes of horizontal, vertical or low ceiling types for steam or hot water now in production, also electric units. All backed by "ONE-NAME-PLATE" Guarantee. Write us or phone nearby Branch Office (consult classified directory) for latest specifications.

ILG

UNIT HEATERS AND VENTILATION

WRITE OR PHONE FOR CATALOG

Find out how ILG Unit Heaters save eight ways on fuel, floor space, power.

WANTED: GRADUATE ENGINEERS!

for ILG Branch Offices, Research, and Engineering Departments. Exceptional opportunities now and post-war for graduates of accredited technical schools. Send details on education, experience, health, age, and marital status.

ILG ELECTRIC VENTILATING CO., 2841 N. Crawford Ave., Chicago 41, Ill.
Offices in 40 Principal Cities

GET SET WITH FREEMAN STOKERS

FIRST CHOICE OF AMERICA'S FOREMOST HEATING ENGINEERS

for PERMANENT, PROFITABLE STOKER VOLUME. GIVE YOURSELF THE SECURITY OF A DEPENDABLE, FINANCIALLY STRONG MANUFACTURER WHO WILL ALWAYS BE IN THE STOKER BUSINESS TO SERVE YOU!

COMPLETE RANGE OF SIZES UP TO 1200 POUNDS PER HOUR

FREEMAN STOKER DIVISION
ILLINOIS IRON & BOLT CO.
918 S. MICHIGAN AVE., CHICAGO 5, ILLINOIS

Research Division Creates New Sections

No. 2922—The Development and Research Div. of The International Nickel Co., Inc., has formed three new sections within the division: industrial chemicals section, headed by O. B. J. Fraser; corrosion engineering section, with F. L. LaQue in charge, and iron and nonferrous casting section, headed by Donald J. Reese.

Mr. Fraser has directed the company's investigational work at Mellon Institute of Industrial Research, Pittsburgh, Pa., on certain problems in the chemistry and technology of nickel with reference to the preparation, properties and uses of nickel compounds, especially organic derivatives and nickel catalysts.

The function of the corrosion engineering section will be to coordinate the broad interests of the company and its customers in the choice and application of nickel-containing alloys where resistance to corrosion is required.

As head of the iron and nonferrous casting section, Mr. Reese will coordinate more closely the company's development work on cast iron, malleable iron, cast brass and bronze. He has just recently resumed his duties with the company after having been with the steel division of the War Production Board at Washington for almost three years.

Industrial Electronics Training Course

No. 2923—A new industrial electronics talking slide film training course which offers a practical and quickly grasped understanding of the subject of industrial electronics, has been announced by the General Electric Co., 1 River Rd., Schenectady 5, N. Y. Carefully organized for presentation in 12 sessions, the course is "expected to have wide use throughout industry wherever electronic equipment is applied or a knowledge of it is required."

In industrial plants, the course should provide electrical personnel with sufficient theory and application information to acquaint them with electronics in general; production and process engineers engaged in reducing production costs should find that it offers innumerable practical suggestions; designing engineers involved with improving products should obtain much stimulation and a variety of new ideas; practical electricians should acquire from it an increased working knowledge of electricity and ample information to encourage them to install and service electronic equipment; and production managers and plant superintendents should discover a wealth of opportunities for cracking open production bottlenecks by electronic methods, according to G. E.

Presented throughout in a clear, nontechnical manner, the course consists of 12 talking slide films (35 mm film strips and 16 in., 33⅓ rpm records) each approximately 30 minutes in length; 25 copies each of 12 lecture review booklets keyed to the slide films; an instructor's manual covering the presentation of all 12 lectures; and a carrying case designed to accommodate the complete course.

Fuel Conservation in Hospitals—In the review of the American Hospital Association's new booklet on Fuel Conservation in Hospitals, on page 430 of the August HPAC, the price of the cloth cover edition was given as $1.00; this should have been $1.25. The paper covered booklet costs 75c.

Have you checked your Steam Heating System?

If you have not prepared for the winter months just ahead, repair or replace worn or obsolete steam-wasting units *now* before the peak of the seasonal rush arrives, with its confusion and delays.

Modernize with ILLINOIS Specialties

Equip your radiators with smooth-acting Illinois Supply Valves and sensitive, steam-tight Illinois Thermo Traps.

Improve system operation by replacing thermostatic drip traps with Illinois Float and Thermostatic Traps, wherever rapid elimination of condensate is essential.

You can also enjoy the further comfort, convenience and economy of fully automatic control at low cost, by adding Illinois Selective Pressure Controls to your present system.

Investigate these latest developments and refinements in heating system control now available.

ILLINOIS ENGINEERING COMPANY
INCORPORATED 1900
RACINE AVENUE AT 21ST STREET • CHICAGO 8

• WPB . . . OPA . . . PAW . . . Etc. •

Solid Fuel Controls Remain, Says Ickes

The followng memorandum regarding the current coal situation was issued by Solid Fuels Administrator Harold L. Ickes at a press conference on August 23:

"Estimates submitted yesterday by the Solid Fuels Requirements Committee show that during the fuel year ending next March 31, the nation will need from 570,000,000 to 585,000,000 tons of bituminous coal, depending upon how much we can make available for export to Europe. We do not intend to send Europe any of the coals normally used here for home heating. It is hoped that our original production estimate of 575,000,000 tons for this period can be reached, although we must have continuous peak operations on a most favorable basis to attain it. There will be little change in anthracite requirements or production over estimates made prior to Japan's defeat.

"The Army, Navy, and Marine Corps reported that their requirements for the coal year are unchanged by the defeat of Japan. The War Production Board and SFAW estimate that requirements for home heating and other non-industrial consumption will be unchanged and in fact would be larger if we had the coal. The Foreign Economic Administration's requirements for export coal showed an increase, and the War Production Board believes that the cement mills will need more coal than before Japan fell. Relatively small decreases were reported for all other categories of industrial consumers, the largest of which was in general manufacturing which represents about 15 per cent of our total consumption.

"It is obvious that at least for the present we must continue to maintain certain controls over the distribution of solid fuels, including the 80 per cent quotas established for the domestic heating sizes of coals produced in the east. However, we may be able to permit domestic consumers who can burn the so-called steam sizes of eastern bituminous coals to have 100 per cent. We probably can avoid reinstating the 80 per cent quotas for the midwestern coals and there will be no restrictions on the coals produced west of the Mississippi River."

Higher Price Allowed on Cast Iron Tube Radiation

An increase of about 8½ per cent in manufacturers' resale prices for cast iron tube radiation was allowed, effective August 22, 1945, according to the OPA. The increase raises manufacturers' maximum prices by about 2½ cents net per sq ft. This amount may be passed on by all resellers.

Cast iron tube radiation is a standardized commodity of hollow tubular shapes that are assembled into radiators for low pressure steam, hot water, and vapor home and factory heating systems.

MORE *Engineering* DATA on **BALDOR** GLASS INSULATED MOTORS

The better the insulation, the better the motor

BALDOR, the Better Motor, is made even better by the use of GLASS INSULATION because—

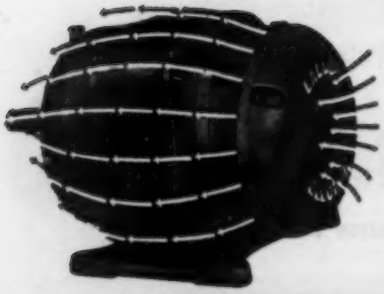
Glass insulation withstands HIGHER TEMPERATURES—as high as 250° C. as compared with 95° C. critical limit for cellulose insulation. Result, less chance for break-down.

Glass insulation makes possible MORE COMPACT, LIGHTER WEIGHT motors. (For example: 10 H.P. motors in standard 7½ H.P. frames . . . and with 135 lbs. LESS WEIGHT.)

Glass insulation is non-hygroscopic—the dielectric strength remains almost as high in humid or damp surroundings as in a dry atmosphere.

Being inorganic, glass insulation does not rot nor deteriorate even when constantly exposed to dampness.

May we tell you more about these BALDOR Better Motors?



Above: BALDOR STREAMCOOLED MOTOR; totally enclosed. Arrows indicate air travel over ENTIRE EXTERIOR of motor.

BALDOR ELECTRIC COMPANY

General Offices: ST LOUIS 10, MO. *District Offices in Principal Cities*

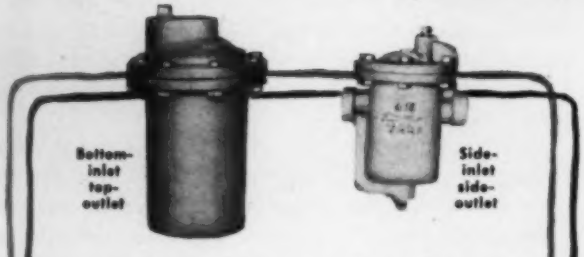
PLAN YOUR POST-WAR MOTOR REQUIREMENTS *Now.* Get the Latest BALDOR Bulletins

HOW TO TRAP

PIPE COIL RADIATION

...for lower fuel consumption

One of a series of advertisements, each discussing trapping practice on a different class of equipment.



Pipe Coil Trapping Tips*

- Select traps of sufficient capacity to handle the warming up load.
- Select traps with adequate automatic air removal capacity.
- Where extremely fast heating is desired, use traps with automatic air by-pass.
- Be sure pressure on supply side of trap is higher than in return line.

*Complete data, diagrams, tables, capacities, selection factors in 36-page CATALOG H, available on request.

No. 213 Trap Drains Lines in 30 Seconds!

The correct selection and installation of steam traps for draining pipe coils pays big dividends in fuel savings, faster heating and higher temperatures. At the Plylock Corporation, Portland, Oregon, Armstrong traps were installed on a Coe lumber drier after tests showed no steam loss and drainage of condensate in 30 seconds after lines were shut off eleven minutes to allow condensate to accumulate. Other reports from Armstrong users include: 190% return on trap investment; saving of 211 tons of coal per season; saving of carload of coal per trap; $1,067 coal saving.

Many engineers may question how a few steam traps can effect such fuel savings. The explanation is not difficult:

1. Armstrong traps don't leak steam.
2. Armstrong traps automatically discharge air that would otherwise reduce heat transfer efficiency.
3. Armstrong learned the hard way from practical experience on thousands of installations what sizes and types of traps to use and where and how to install them—you can profit from this. For the name of the nearest Armstrong distributor, address: ARMSTRONG MACHINE WORKS, 874 Maple Street, Three Rivers, Mich.

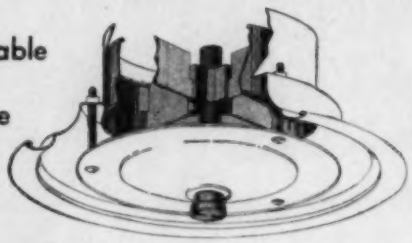
ARMSTRONG STEAM TRAPS

Over a Million in Use...For Power...Process...Heating

Control of air direction and volume as an aid to satisfactory supply air diffusion

Whether they are used in heating, cooling, ventilating, or combined systems, KNO-DRAFT Diffusers can be adjusted quickly and accurately for system balancing and individual or seasonal requirements. As a result the factors of temperature variation, temperature fluctuation, drafts and noise can be minimized considerably.

Type K Adjustable Diffuser with Type D Volume Damper for supply air.



Pat. and pat. pending

Any desired condition at your fingertip.

Type SR Adjustable Diffuser for supply and return air.

By simply turning the air adjustment screws (easily accessible from under the unit) the inner cone may be raised or lowered to secure any angle of air direction required. A built-in damper, with which either model can be equipped, varies the outlet aperture uniformly without affecting the outlet velocity or diffusion pattern. Thus, the air direction and volume of the same KNO-DRAFT Diffuser can be adjusted to be equally effective in expelling chilled air parallel to the ceiling or ejecting heated air downward to prevent stratification.

With KNO-DRAFT Adjustable Diffusers many engineers have been able to insure efficient air distribution, maximum premixing of room and supply air, noiseless and draftless diffusion and uniform temperature throughout the occupied zone. And they have been able to reduce labor and sheet metal costs by distributing large volumes of air at higher duct velocities in smaller, simplified ducts with fewer outlets, because KNO-DRAFT Diffusers permit the use of higher neck velocities.

The W. B. Connor Engineering Corp. maintains a staff of specialists and district representatives in leading cities to assist you with any air distribution problem.

FREE HANDBOOK

Contains clear sketches, charts, dimension prints and instructive text that simplify the selection and installation of air diffusers. For your copy write Dept. D7.

W. B. CONNOR ENGINEERING CORP.

Air Diffusion *Air Purification* *Air Recovery*

114 E. 32nd Street — CONNOR — New York 16, N. Y.

Many War Controls Ended, Priorities System to Go

Moving swiftly to facilitate reconversion and speed the flow of peacetime products into consumers' hands, the War Production Board has already dropped hundreds of individual controls over industry. Among the controls eliminated which affect this particular industry directly are those over heating, plumbing, and cooking equipment. L-79, restricting the sale of furnaces, boilers, radiators, and water heaters, was revoked effective August 17, 1945. Restrictions on the acceptance of all types of additional residential space heating and on the industrial consumption of gas by utility companies (U-7) were removed, effective August 20, 1945. Controls on oil burning equipment (L-349) and on industrial type instruments (L-272) were removed August 21.

Allocation controls have been removed from silica gel, which was used by the military chiefly for packaging to prevent moisture damage, the WPB has reported. The revocation of schedule 53 (silica gel) of the general chemical allocation order M-300 is in line with the WPB policy of releasing controls when the supply permits such action. Silica gel is used in air conditioning for dehumidifying air.

Another reconversion move announced August 21 by the WPB was the relaxation of construction controls to permit industrial building without WPB authorization. Affected are factories, plants, and other units used primarily for manufacturing, processing or assembling of goods or materials; work on units not primarily used for industrial purposes if the construction is to prepare a part of the unit for such work; and construction of facilities owned by a manufacturer that are necessary for handling raw materials or components, or for the distribution of his products to the retailer.

Chief among the types of work considered manufacturing, processing or assembly, for which direction 7 of order L-41 now permits construction without authorization, are: (1) mining, smelting, refining, foundries, and other operations related to extraction of materials and their conversion to finished form; (2) logging and lumbering operations, sawmills, planing mills, and millwork manufacturers; (3) pilot plants and industrial research laboratories; (4) food processing plants, slaughterhouses, commercial food freezing plants, commercial cold storage warehouses and food packing plants, bottling plants, grain elevators and canneries; (5) textile mills, cotton mills, and similar establishments; (6) printing and publishing establishments, including those publishing newspapers or printing books, magazines, or periodicals.

A further relaxation of order L-41, announced September 6, permits alterations and repairs on existing buildings—not involving exterior additions—without authorization regardless of the type of work or cost. Controls have also been removed on the construction of transportation facilities and on farm buildings other than farm houses.

The Office of War Utilities has amended utilities orders U-1, U-3, and U-4, the basic war regulations covering construction of new facilities by and providing maintenance, repair, and operating supplies

"Columbia" Activated Carbon REMOVES Odors from Air

1 It deodorizes stale air for return to air conditioning systems.

2 It purifies intake air to remove objectionable outside odors.

3 It removes objectionable odors from exhaust air.

Installations for deodorizing air with "Columbia" Activated Carbon are supplied by a number of reputable engineering firms. Write for name and address of the supplier near you.

•

CARBIDE AND CARBON CHEMICALS CORPORATION
Unit of Union Carbide and Carbon Corporation
UCC
30 East 42nd Street, New York 17, N. Y.

BUY UNITED STATES WAR BONDS AND STAMPS

COLUMBIA
Activated Carbon

Life-Saver for Men and Materials

SOLVENT RECOVERY · CATALYSIS · GAS AND AIR PURIFICATION

WITH A LONG AND CONTINUOUS RECORD OF SUCCESSFUL CONTRIBUTIONS TO THE VAPORIZING OIL BURNER INDUSTRY . . .
Now Announces THE REVOLUTIONARY NEW
magic pilot
FOR MAINTAINING A CONSTANT PILOT FEED INDEFINITELY
Improving . . .
the successful operation of Vaporizing Oil Burning Appliances has always occupied much of the engineering thinking at "A-P". As a result, manufacturers of this equipment have acquired the habit of coming to "A-P" with all their control problems. This has created an impressive list of "firsts" in the industry that have constantly offered the dealer greater profit opportunities.
HAS BEEN First . . .
to offer Custom-Calibrated Metering
to provide Control with the Viscosity Selector
to furnish Control with Electric Conversion Top for Automatic Temperature Regulating
to develop the "Oil Lifter" to pump oil from remote storage to heater
to develop successful automatic control for Vaporizing Oil Burning Hot Water Heater
to equip with Automatic Temperature Control, adding EXTRA profit-making devices without need for troublesome changes or adjustments.
NOW OFFERS the new "MAGIC PILOT" in the "A-P" Constant Level Oil Control — maintaining a constant pilot feed indefinitely.
Completely revolutionizing the automatic control of oil-burning water heaters, floor furnaces and furnaces, this new "A-P" MAGIC PILOT maintains a constant pilot flame indefinitely by automatically controlling the oil flow required by the low-burning pilot. The oil flow orifice prevents clogging and oil waxing.
Again, "A-P" advanced thinking and engineering provide new applications of automatic heat control — bring new markets, greater profits to manufacturers and dealers of vaporizing burning appliances. Write for bulletin describing the new, service-free "A-P" Oil Control with "MAGIC PILOT."
AUTOMATIC PRODUCTS COMPANY
2460 NORTH 32nd STREET • MILWAUKEE 10, WISCONSIN
DEPENDABLE
Oil Controls
"A-P" CONTROLS ARE DESIGNED TO ELIMINATE SERVICING!

priorities for electric, water, gas, and wire communications facilities. These orders will expire September 30, the WPB reported. The amendments will remove the provision requiring WPB approval for construction of buildings costing more than $25,000.

Action was taken by the WPB August 22 to eliminate at the end of September the wartime priorities control system, including the controlled materials plan, and to substitute a new, limited system for use during the reconstruction period. The changes were made through amendments to priorities regulations 28 and 29. The new priorities regulation 29 provides:

Cancellation, effective August 22, of all AA preference ratings (which includes all ratings except the special top priority AAA, the new military MM rating, and the new CC rating described below) on purchase orders that call for delivery after September 30, 1945. There is one exception—the AA ratings will still apply to textiles.

The revocation of the controlled materials plan, effective September 30, 1945.

Cancellation, effective at once, of all allotments of steel, copper and aluminum (the three "controlled materials") for the fourth and subsequent quarters.

Introduction of a new junior, non-extensible, civilian CC preference rating to be used in limited cases to break bottlenecks in reconversion and insure, when necessary, continued production and services.

The new priorities regulation 28 explains when the new junior non-extensible CC rating will be assigned. The WPB cautioned that its general policy is not to assign priorities assistance for non-military needs. The new CC rating will be used sparingly. It is expected that almost all materials will either be in surplus or in comfortable supply, and that ratings will therefore generally not be needed. The applicant must show that he has not been able to get delivery without a rating, and that the item to be rated is a "bottleneck" holding up minimum production, or that it is needed for reconversion construction or other essential construction. The CC rating may be assigned, where needed, to increase production to eliminate reconversion bottlenecks, or in other cases to protect public health and welfare or prevent extraordinary hardships. CC ratings may also be assigned in limited cases for essential exports.

The WPB said it would continue its policy of giving small business opportunity to obtain its fair share of materials. To this end, WPB officials have been instructed, in considering applications for the new CC rating, to give special consideration to the needs of small business. The CC rating is non-extensible. It cannot be extended by a supplier to get production materials or components to make the item sold to his customer, or to replace in inventory materials used to make the item, or for any other reason.

The MM rating originally introduced under priorities regulation 29 for military use will be continued for the time being to support the requirements of the occupation forces and other continuing military needs. Priorities regulation 30, which provided for direct assignment of MM ratings under certain circumstances, has been revoked. Through September 30 the MM rating is equivalent to AA-1, and the CC rating is equivalent to AA-2. After September 30 the sequence of ratings will be AAA, MM, CC, in the order named. All preference ratings in the AA series are cancelled on purchase orders calling for delivery after September 30.

This tiny area is *Vital* to your comfort...

In this area of comfort air conditioning the Kathabar System eliminates Chill... Shock... and Clamminess

The saying, "it isn't the heat... it's the humidity", is true. Humidity can be the factor of success, or failure, in any plan for air conditioning. The success of the Kathabar System in providing true comfort atmospheres is due to its simplicity of operation, functioning as it does independently of temperature —accurately and automatically dehumidifying or humidifying to obtain the desired condition.

Personal comfort air conditioning does not have the same meaning to all people. "Some like it 'hot' and some like it 'cold'", but it is certain that none of them want CHILL, SHOCK and CLAMMINESS ... all three a result of lack of control of humidity.

The Kathabar System absorbs moisture from the air in accordance with predetermined controls. Therefore, the air is never arid, or clammy. The control can be set to maintain just the proper amount of humidity for *true* comfort.

Kathabar Systems save in operating and maintenance expenses, too! From the above illustration comparative methods give evidence of this statement. Note that Kathabar dehumidifies-humidifies to maintain the desired humidity ... then, the air is slightly cooled by one of three methods. This is the most desired and sure method of approaching the area of comfort. It is not necessary to use expensive Over-cooling to remove moisture ... then to Reheat to the area of comfort.

REMEMBER, there is more than one method of approaching comfort or industrial air-conditioning problems. Permit our MOISTURE ENGINEERS to tell you the complete story of "functional air-conditioning" and time-proven Kathabar Systems ... where Kathabar Systems meet the need in air-conditioning applications and how savings can be made in initial cost and operating and maintenance expense.

"The Moisture Engineer" is a new bi-monthly bulletin devoted to moisture-humidity problems in air conditioning, and to Kathabar Systems and their application. Circulation will be limited. However, additional names can still be added to territory lists at the present time. If you would like to receive it, write to—

KATHABAR DIVISION, SURFACE COMBUSTION CORPORATION, TOLEDO 1, OHIO

AUTOMATICALLY CONTROLLING HUMIDITY FOR COMFORT AND INDUSTRIAL PROCESSING

Kathabar System of
HUMIDITY CONTROL
(ADVANCED AIR CONDITIONING)

NEW BOOKS & REPORTS

IBR Testing and Rating Code for Low Pressure Heating Boilers

Coincident with the lifting of wartime restrictions on the manufacture of heating equipment, the Institute of Boiler and Radiator Manufacturers has published the third edition of its IBR Testing and Rating Code for Low Pressure Heating Boilers. Right off the press at a time when heating and piping contractors are looking forward to the largest market for heating equipment in the nation's history, the code is a timely aid to the industry in providing the consumer with dependable heating equipment, says the IBR.

The purpose of the code is to provide a reliable and uniform procedure for measuring the performance of all cast iron heating boilers, regardless of design, heating surface, grate area, and other variations.

The first edition of the code was published in 1939. Prior to that time there had been no commonly accepted method of determining the gross output or net rating of cast iron heating boilers. The second edition was published in July 1940; in it there were incorporated some amendments to the original code which, in the light of extended experience, added to the precision of results.

Prior to the publication of the first edition of the code in 1939, there was a long development period during which the members of the institute extended the fullest cooperation for the formulation of the details of the code. Manufacturers made their confidential test data available to the institute to permit utilization of their combined experience in the technique of boiler testing.

Between 1939 and 1942, a majority of all boilers up to 41 in. in grate width were tested under the code and their outputs expressed as IBR ratings. During the war period, the testing of larger boilers has been delayed due to shortage of manpower and fuel. The engineering representatives of the industry have maintained a constant study of testing and rating procedure. The result is that the third edition of the rating code is now presented for determining the ratings of all cast iron low pressure heating boilers, regardless of size.

The code is divided into four parts: Rating of boilers; testing of hand fired boilers; testing of oil fired boilers; and procedure for obtaining IBR ratings. Copies have been sent by the institute to all manufacturers of cast iron heating boilers, educational institutions, government agencies, and the interested committees of associations in the heating industry. Copies are available from the Institute of Boiler and Radiator Manufacturers, 60 E. 42nd St., New York 17, N. Y., for $1 each. It comprises 73 mimeographed pages, 8½ by 11 in., with a paper cover.

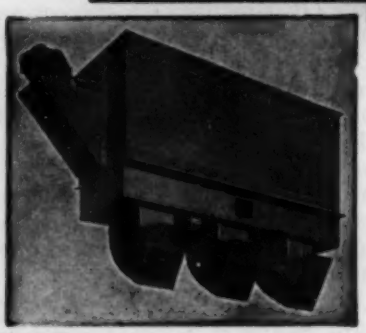
Thermodynamic Properties of Air

Following a pattern similar to the widely used steam tables, the authors of Thermodynamic Properties of

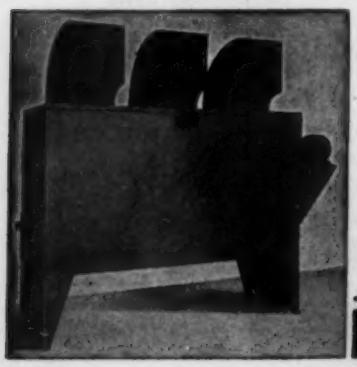
Available for Prompt Delivery—

THE AIRTHERM CENTRIFUGAL FAN TYPE, STEAM UNIT HEATER

(Vertical, Horizontal, or Floor Type Models)



Ceiling mounted, inverted type.



Floor mounted.

The Airtherm centrifugal, fan type, steam unit heater is a highly efficient heater for either vertical or horizontal suspension and is available to you for delivery during the present heating season.

This high velocity unit insures uniform temperature distribution and maximum heat flow effecting savings in both fuel and maintenance cost. Capacities range from 200,000 to 825,000 B.T.U.

Send us your specifications or write for the Airtherm Catalog today. Our engineers will gladly work with you in planning efficient heat for your plant.

AIRTHERM MANUFACTURING COMPANY

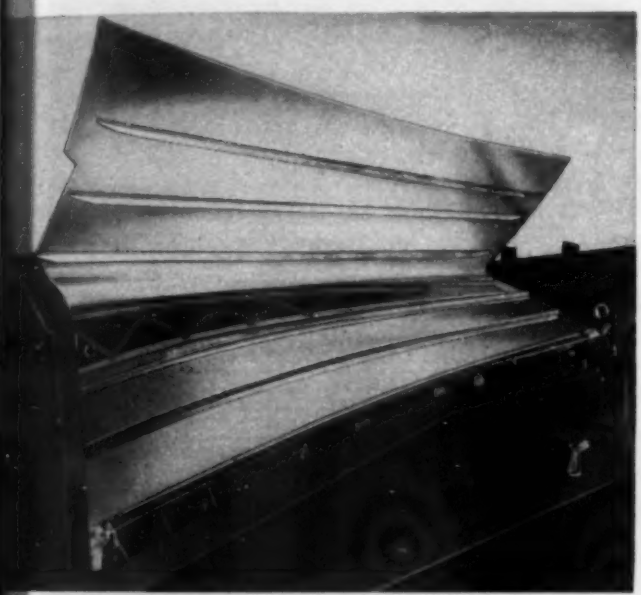
711 South Spring Avenue • St. Louis 10, Missouri

FAN FEATURES

that contribute to the economy and efficiency of

Pritchard COOLING TOWERS

DYNAMIC BALANCING is standard procedure in the production of Pritchard Featherweight Fans. Test apparatus includes this rig using an electronic balance indicator.



JIG FORMED for strict uniformity, blades are shaped from a single heavy wrought monel sheet with the trailing edge electric-welded. Note the welded-in "wing spar" and stiffening webs for staunch rigidity and endurance.

HUB SLEEVE on fan shaft provides key and set screw locking, yet permits removal of the fan assembly without driving the sleeve off the fan shaft.

Here are a few of the reasons why Pritchard FEATHERWEIGHT Fans are acclaimed by operators as the optimum answer to cooling tower fan problems:

1. LIGHT WEIGHT for low starting torque, minimum vibrational reaction and low loading on fan shaft bearings.
2. MONEL METAL BLADES for corrosion resistance and maximum delivery of air in ratio to horsepower.
3. ANTI-BACK-DRAFT HUB for streamlined flow of air; no turbulence or air return.
4. TRUE AIR-FOIL SECTION of blade equalizes air propulsion over full length of each blade. Practically noiseless in operation, with high efficiency at low tip speeds.
5. ADJUSTABLE BLADE PITCH permits selection of most desirable setting for any tower loading.
6. HUB SLEEVE (see lower left) permits easy removal of fan for winter operation and also makes quick work of removing the gear unit for servicing.

Continuous trouble-free performance over more than five years demonstrates the advantages of Pritchard's patented design and features, the result of comprehensive research to minimize power requirements, reduce maintenance and extend the life of mechanical draft equipment. These proven units are easily installed as replacements for obsolete, inefficient fan assemblies. They will pay for themselves quickly in savings of power, maintenance and down-time.

EQUIPMENT DIVISION

J.F. Pritchard & Co.

ENGINEERS AND CONSTRUCTORS

FOR THE CHEMICAL • PETROLEUM • GAS AND POWER INDUSTRIES

FIDELITY BUILDING, KANSAS CITY 6, MO.

NEW YORK - PITTSBURGH - HOUSTON - ATLANTA - TULSA
DENVER - SALT LAKE CITY - EL PASO - OMAHA

A Better STRAINER

- Cadmium Plated Inside and Out
- High-Grade Woven Monel Wire Screen
- Readily Removed Steel Blow-Off Bushing
- Screen and Bushing Come Out Together—Go Back Together, Automatically Aligning
- For Steam Lines or Water, Oil and Other Fluids
- Reasonably Priced
- 6 Sizes from ½" to 2" for Pressures up to 600 lbs
- Many Thousands in Service
- Sold by Over 100 Mill Supply Houses

See Your Supply House or Send for Bulletin S-200

YARNALL-WARING COMPANY
107 MERMAID AVENUE · PHILADELPHIA 18, PA.

YARWAY STRAINERS

Air, Joseph H. Keenan and Joseph Kaye, both of the Massachusetts Institute of Technology, have calculated tables for these properties, assuming a volumetric composition of 78.03 per cent nitrogen, 20.99 per cent oxygen, and 0.98 per cent argon.

The book will be found most useful in calculating processes which occur with large changes in temperature and pressure, and for that reason several of the tables are unnecessary for typical heating and air conditioning problems. Nevertheless, the concise presentation of physical properties and enthalpies for a very wide range of temperatures will be found very convenient; and there is a valuable reserve of information in the remaining tables.

With 400 F absolute (—59.7 F) as a datum, values of enthalpy, internal energy, and entropy are presented for low and moderate pressures over a range of —160 F to 6000 F. Physical properties of air, such as viscosity, specific heats, and thermal conductivity, are given for temperatures from —60 F to 2000 F. Several tables of conversion factors, including detailed tables for temperature conversion, Centigrade to Fahrenheit and the reverse, will be found very useful.

Several tables of the square root, exponential, and logarithmic functions of ratios that occur frequently in compression and expansion processes are given. These can be used for gases other than air as well.

The wealth of information presented in the book justifies a most hearty recommendation.

It is published by John Wiley & Sons, Inc., 400 Fourth Ave., New York 16, N. Y. There are 73+ iii pages, 7½ x 10¼ in., and the price is $2.25.—*Reviewed by Robert L. Rose.*

No. 7032—AIRO-FLEX REGISTER

ADJUSTABLE

AIR DIRECTIONAL REGISTERS

This model is a simple, sturdy, moderate priced register suitable for most forced air heating jobs. Modern and pleasing in appearance, it has single louvre and bendable fins, set when delivered at about 22° downward. Furnished for wall and baseboard registers and intakes. It's an efficient, easily installed register, which does not run up the cost where the job must be kept within limits.

Auer offers a complete line of floor, base, and wall registers and return faces, for gravity or air conditioning systems—including all air directional types. We also make flat metal grilles. Ask for Auer Register Book—or special Grille Catalog "G."

THE AUER REGISTER CO., Cleveland, O.

AUER REGISTERS
& GRILLES · For Air Conditioning and Gravity

This happens to the best galvanized sheets...

Galvanized sheet steel is an excellent metal for many purposes, but there is one thing it won't do. It won't take and hold paint satisfactorily. The photo tells the story. The raw zinc dried out the essential oils in the paint, caused it to become brittle. Result: early paint failure.

This happens even when the zinc surface is acid-etched. Etching has other disadvantages, too. Besides being slow and costly, it destroys part of the protective zinc coating.

Paint on regular galvanized steel *isn't* satisfactory . . .

But this bonds paint to zinc

ARMCO Galvanized PAINTGRIP sheets are the answer to this old problem. What's more, they give heating and air-conditioning equipment this *triple protection* . . .

1. The high-quality steel base has a *full-weight zinc coating.*
2. The coating is given a special Bonderizing treatment at the Armco mills.
3. This "insulated" surface grips the attractive paint finish in a lasting bond — prevents it from drying out quickly and peeling and flaking.

ARMCO Galvanized PAINTGRIP is the logical choice for heating and air-conditioning construction that is to be given an attractive, durable paint finish. Write for the free booklet on this special-purpose steel sheet. It gives complete information. The American Rolling Mill Co., 1761 Curtis St., Middletown, O.

EXPORT: THE ARMCO INTERNATIONAL CORPORATION

The "Scratch Test" shows how paint sticks to ARMCO Galvanized PAINTGRIP steel. The top half of the sample is mill-Bonderized. When scratched with a penknife only a slight mark can be seen. Paint on ordinary galvanized steel (bottom half) peels off readily.

The American Rolling Mill Company

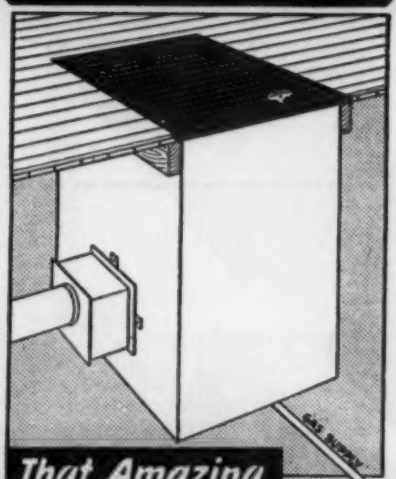
SPECIAL-PURPOSE SHEET STEELS

GALVANIZED PAINTGRIP ARMCO STEEL

JOHN ZINK

One of the largest manufacturers of Gas and Oil Burners in the world manufactures a - - - - - - - - -

FLOOR FURNACE



That Amazing JOHN ZINK FLOOR FURNACE

As you would expect this Furnace features a larger, improved combustion chamber and a One-port Non-plugging Gas Burner.

•

John Zink Low Pressure Burners

for

DOMESTIC FURNACES
HEATING BOILERS POWER BOILERS
GASOLINE PLANT BOILERS

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Aggressive Dealers Write for Details

•

John Zink Company

4401 S. Peoria Ave. Tulsa, Okla.
342 Madison Ave. New York City

• RECENT TRADE LITERATURE •

For your convenience in obtaining copies of these bulletins, see coupon on page 179. If you write direct to the manufacturer, describe carefully what literature you want, as the number given first in each item is for use only when sending in your request to Heating, Piping & Air Conditioning.

Axial Fans and Blowers

No. 5052—A four page illustrated folder (745) published by the Buffalo Turbine Corp., 2165 Bailey Ave., Buffalo 11, N. Y., contains a condensed description of axial flow type fans and blowers, as well as a typical performance curve and dimensions of one of the fans.

Boiler Water Feeders

No. 5053—Products of McDonnell & Miller, 400 N. Michigan Ave., Chicago 11, Ill., are illustrated and described in an eight page bulletin (2523) issued by the company. Wartime uses of boiler water feeders and low water cutoffs are described and other products, such as liquid level controls and flow switches, are briefly covered.

Check Valve

No. 5054—A two page leaflet issued by the Harman Equipment Co., 937 Santa Fe Ave., Los Angeles 21, Calif., describes the "Permatite" check valve, which has no metal working parts. A cutaway view shows construction of the valve.

SPRAY NOZZLES that GUARD YOUR REPUTATION

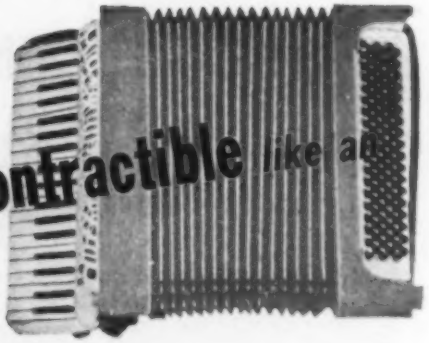
Standardizing on Spraying Systems nozzles and accessories guards against unsatisfactory operation of equipment in which liquid spraying plays any part. These hydraulically engineered nozzles are precision-built to spray with maximum efficiency and at lower cost, whether on a simple washing job or in a complex air-conditioning system.

Catalog No. 22 tells how to get these better results, describes hundreds of nozzle sizes and types. Write for your free copy today.

SPRAYING SYSTEMS COMPANY
4033 West Lake Street Chicago 24, Illinois

SPECIALISTS IN THE DESIGN AND MANUFACTURE OF SPRAY NOZZLES

Expansible—Contractible *like an*



Reinforced *like a*

Yet these similes tell only half the story of what makes the Badger Packless Self-equalizing Expansion Joint the strongest, most dependable and longest lasting product of its kind in the world:

As the reinforcing sleeve of a heavy gun protects the barrel and helps to send the force of the charge in the right direction, so do the protecting ALL-CURVE Equalizing Rings direct the flexing of the ALL-CURVE Corrugations of the Badger Expansion Joint illustrated here.

With corrugations and rings in "synchronized" ALL-CURVE design (exclusive with Badger), flexing stresses are distributed evenly. Stresses cannot "pile up" in any one or more corrugations. Neither are there any angles or "junctions" in which stresses can localize.

Result: No excessive strain anywhere, any time. The flexing member has ample freedom of movement to absorb all expansions and contractions within the prescribed limits of the joint.

Packless construction—due to forming the flexing member from a single piece of tubing—eliminates the need of packing and, consequently, costly packing maintenance, tunneling and manhole construction. *Special heat-treatment*, after forming, preserves flexing qualities and lengthens life.

COPPER or STAINLESS STEEL. Copper for normal pressures and temperatures. Stainless Steel for higher requirements – and where corrosion is a problem. Available in single and multiple corrugations – for traverses from a fraction of an inch upward. Also made in non-equalizing type (without rings) for uses that do not require this added protection.

SEND FOR FREE BULLETIN No. 100

E. B. BADGER & SONS CO., 75 PITTS ST., BOSTON 14, MASS.
Agents in Principal Cities

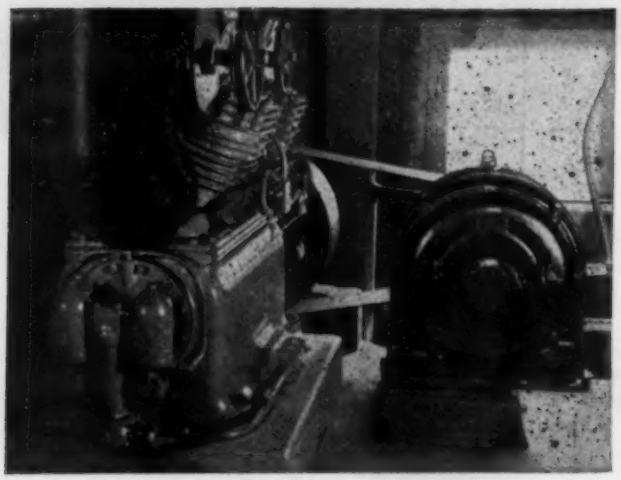
Badger

PACKLESS CORRUGATED EXPANSION JOINTS

IF IT'S BADGER-MADE IT'S GOT SOMETHING!

A Truly Satisfactory

SHORT CENTER BELT DRIVE

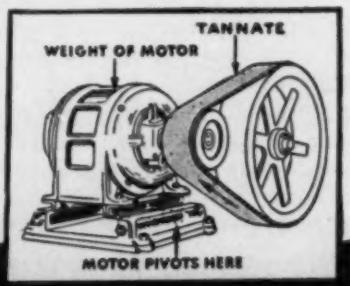


INSTALLED IN 1939 on 100 H.P. motor operating compressor for air conditioning system. It is still running . . . giving excellent service.

The TANNATE-ROCKWOOD short center flat leather belt drive is a distinct improvement in power transmission. The weight of the motor on the pivoted base *automatically* adjusts belt tension, so that there is always *maximum* transmission power, without strain.

The TANNATE belt is a second important factor. Its exceptional grip and flexibility make possible a drive design with a low belt tension. This not only saves wear on the belt and bearings but also provides a margin of extra capacity for peak loads.

Thousands of TANNATE-ROCKWOOD short center drives are now in use, and giving perfect satisfaction. This drive makes possible an efficiency and economy not to be had in drives with a fixed center. May we send you literature, without obligation?



RHOADS
Tannate-Rockwood
SHORT CENTER DRIVE

J. E. RHOADS & SONS

35 North Sixth Street, Philadelphia 6, Pa.

NEW YORK • CHICAGO • ATLANTA

Cooling Towers

No. 5055—Cooling towers are the subject of two bulletins published by the Binks Mfg. Co., 3114-40 Carroll Ave., Chicago 12, Ill. The first bulletin (800) concerns induced draft type towers and the second (900) deals with the atmospheric spray type. Both contain installation and operating data and are illustrated with photographs and scale drawings.

Deaerator

No. 5056—A four page reprint (43) from the Cochrane Corp., 3131 N. 17th St., Philadelphia 32, Pa., describes a deaerator developed for the purpose of removing oxygen and carbon dioxide from cold process waters.

Drying Seed Corn

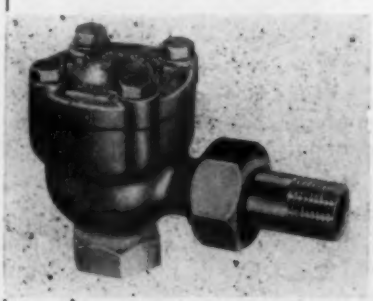
No. 5057—How steam drying coils helped to solve the problem of properly drying hybrid seed corn is one of the interesting stories told in Weather Magic (Vol. 9, No. 3), house organ of the Trane Co., La Crosse, Wis. Also described are the construction problems that arose in a 360-family garden-type apartment project, and the unusual heating techniques employed.

Electronics in Air Filtration

No. 5058—A 20 page booklet (255) issued by the American Air Filter Co., Inc., 107 Central Ave., Louisville 8, Ky., tells the story of the application of electronic air filters to air conditioning and industrial ventilating systems. The theory and practice of such applications are discussed, and among the illustrations is an isometric drawing of an air conditioning system showing the location of an electronic air filter.

STERLING

THERMOSTATIC TRAPS



Sterling Thermostatic Traps are built for pressures from 0 to 150 pounds steam pressure.

Years of service on thousands of installations show efficient, trouble-free service.

↑#9-10 Thermostatic Trap

#7-50	½" x ½"	0 to 15 pounds pressure
#7-14	¾" x ¾"	0 to 15 pounds pressure
#8-10	½" x ½"	0 to 100 pounds pressure
#8-11	¾" x ¾"	
#8-12	1" x 1"	
#9-10	½" x ½"	25 to 150 pounds pressure

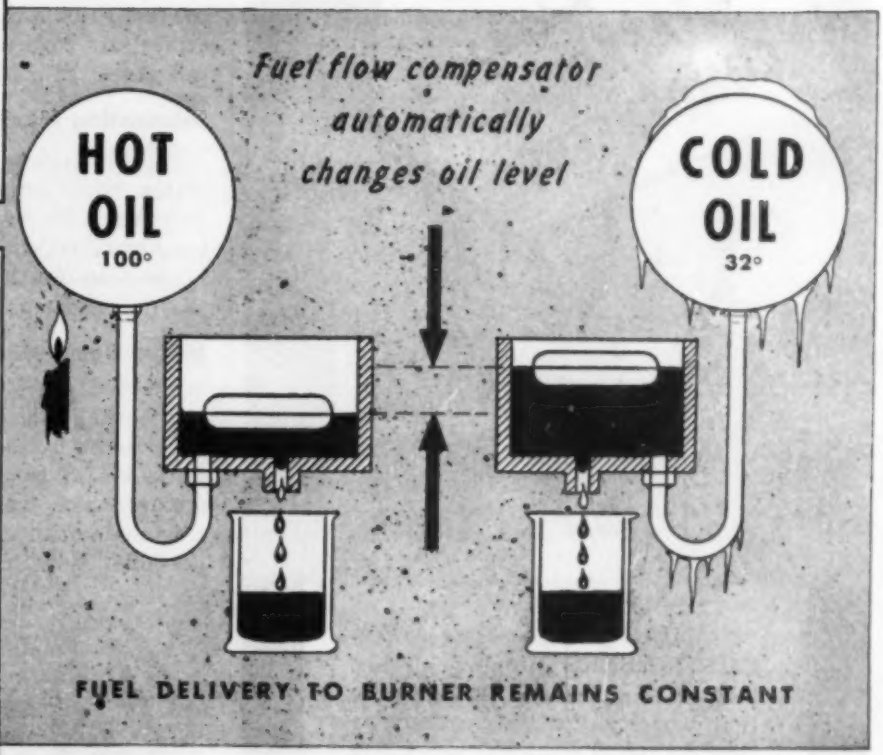
STERLING, INC.

3738 North Holton Street Milwaukee 12, Wis.

Heating Specialties, Process Temperature Controls, Heating Pumps, Automatic Radiator Controls

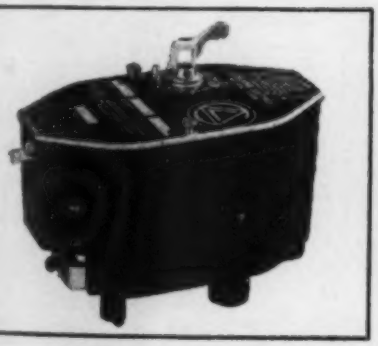
Steady, even fuel flow regardless of oil temperature with "DL" FLOAT VALVES

The automatic fuel flow compensator does it!


Fuel flow compensator automatically changes oil level
HOT OIL 100°
COLD OIL 32°
FUEL DELIVERY TO BURNER REMAINS CONSTANT

The viscosity of fuel oil varies with the temperature. Cold fuel oil flows slowly—warm oil, freely. Without the automatic compensator, the fire in the burner would die down if the fuel were cold. If the fuel were warm, too much would be fed to the burner, with resultant waste and overheating.

The automatic compensator "feels" the temperature of the fuel oil and raises or lowers the position of the float—increasing or decreasing the head pressure on the metering valve to maintain constant fuel flow.



THE automatic fuel flow compensator consists of a piece of thermostatic bi-metal which supports the float. When the fuel oil is cold the bi-metal warps and raises the float—allowing the oil level in the float valve body to rise. When the fuel is warm, the bi-metal compensator warps in the opposite direction, lowering the float and consequently the liquid level. Since the fuel delivery through the metering orifice depends upon the head pressure above the needle and the viscosity of the oil, this action of raising or lowering the float results in a uniform rate of fuel delivery regardless of fuel temperature.

This method of compensation, using the temperature of the fuel, is an important feature.

It is but one of the many reasons why you should insist upon "DL" equipped heaters when you are selecting a line to sell.

DETROIT LUBRICATOR COMPANY General Offices: DETROIT 8, MICHIGAN

Canadian Representative—RAILWAY AND ENGINEERING SPECIALTIES LIMITED, MONTREAL, TORONTO, WINNIPEG

Division of AMERICAN RADIATOR & Standard Sanitary CORPORATION

"DL" Heating and Refrigeration Controls • Engine Safety Controls • Safety Float Valves and Oil Burner Accessories • Radiator Valves and Balancing Fittings • Arco-Detroit Air and Vent Valves • "Detroit" Expansion Valves and Refrigeration Accessories • Air Filters • Stationary and Locomotive Lubricators.

Your own Plant will give you more Production and better quality when you install...

NIAGARA Duo-Pass AERO CONDENSERS

NIAGARA Duo-Pass AERO CONDENSERS provide a sure method of increasing the refrigeration capacity of a system that has been in use for several years. Its increased condensing capacity, made into a permanent gain by the exclusive Duo-Pass pre-cooling method, results in both power savings and extra refrigeration capacity from your compressors. Using outdoor air as the cooling and condensing medium, the Niagara Aero Condenser removes 1000 BTU from the refrigerant gas per pound of water consumed, providing a saving in the cost of condenser water that quickly returns the cost of installation.

Write for Bulletin 91, for complete information.

NIAGARA BLOWER COMPANY

Over 30 Years Service in Industrial Air Engineering

Dept. HP-95, 6 E. 45th St., New York 17, N. Y.

Field Engineering Offices in Principal Cities

INDUSTRIAL COOLING HEATING • DRYING

NIAGARA

HUMIDIFYING • AIR ENGINEERING EQUIPMENT

Fractional Horsepower Drives

No. 5059—A new catalog on "Wedgebelt" fractional horsepower drives, containing complete specifications and price lists, has been issued by the American Pulley Co., 4200 Wissahickon Ave., Philadelphia 29, Pa. It also contains four pages of condensed and simplified drive tables for a wide range of center distances and drive ratios.

Hospital Air Conditioning

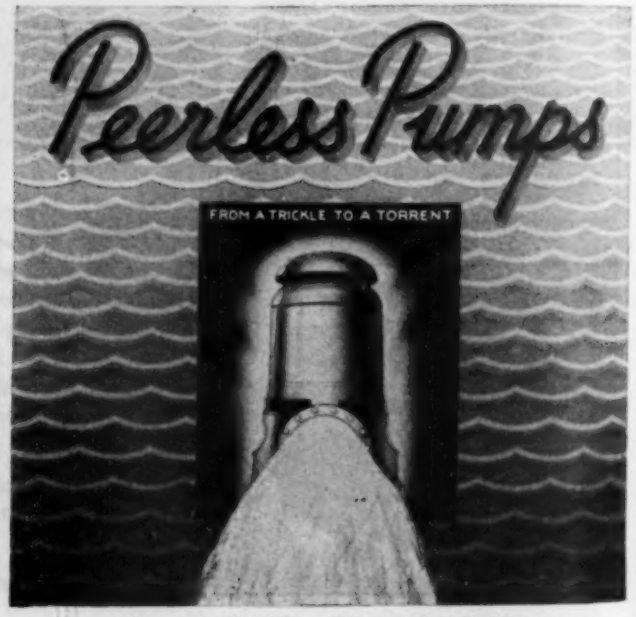
No. 5060—Air conditioning and refrigeration in hospitals are described in a four page reprint (502) issued by the Frick Co., Waynesboro, Pa. The design of a typical air conditioning system is shown, with the arrangement of controls as used in hospital work.

Lubricating Machinery in Public Buildings

No. 5061—A recent issue (Vol. 31, No. 6) of Lubrication, house organ of the Texas Co., 135 E. 42nd St., New York 17, N. Y., is devoted to a discussion of the machinery required to operate public buildings, and its lubrication. Sections on heating, air conditioning, ventilating, and pumping problems are included.

Motor Generator Maintenance

No. 5062—Motor generator maintenance and repair equipment is the subject of a 36 page bulletin (MMH: 645) issued by the Ideal Commutator Dresser Co., 1096 Park Ave., Sycamore, Ill. Included are sections on commutator care, troubles, and remedies; commutator and ring maintenance equipment; coil winding equipment; portable industrial blowers and cleaners; soldering



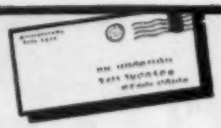
From Deep Wells—15 to 30,000 g.p.m.

Peerless Turbine Pumps, produced in oil or water lubricated types embody many exclusive features. Original pumping efficiencies are closely maintained over a greatly extended performance period.

PEERLESS PUMPS

PEERLESS PUMP DIVISION
Food Machinery Corp.

FACTORIES
LOS ANGELES 31, CALIFORNIA
301 West Avenue Twenty-Six
QUINCY, ILL. • CANTON 6, OHIO



"In three years, the tail outgrew the dog"

"When we took on the Johnson Burner franchise in 1936, we thought of it as merely a supplement to our fuel oil business . . . just a sort of extra attraction like the tail of a dog.

"But it didn't take us long to change our opinion about its importance. In three years the tail outgrew the dog. Almost before we knew it, our profits on burner sales had outstripped our profits on oil.

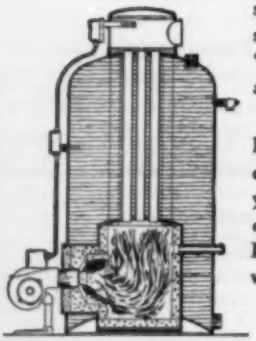
"And that doesn't mean that our oil gallonage fell off. On the contrary, it grew steadily . . . maybe because we got a lot of new customers and friends through selling your fine burners.

"We're looking forward to some big years ahead when Uncle Sam gives the go ahead to private building."

★ ★ ★

Letters like this tell our story better than anything we could add. Perhaps they explain why 75% of the Johnson Dealerships we've established in the past 42 years are *still active and going strong . . . still mutually profitable and mutually cordial.*

If you want extra profits, maybe you too should be selling Johnson Burners. We will gladly let you know if there's an opening in your territory.

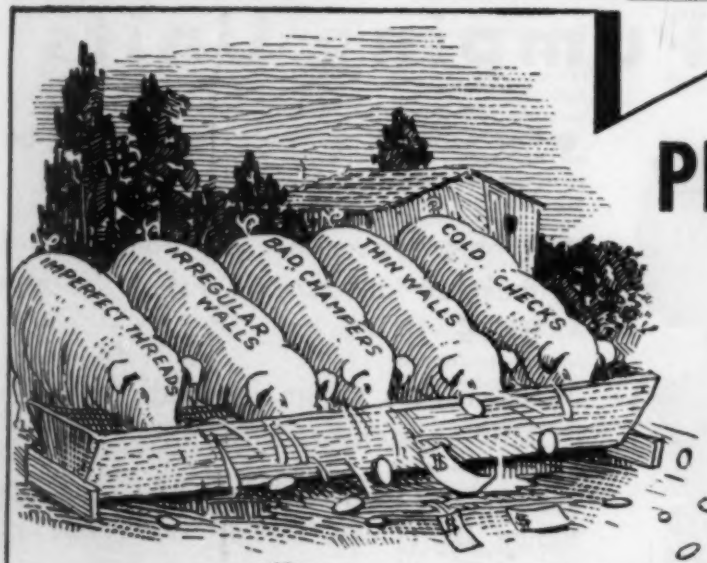


The Johnson Burner line is a *complete* line. Johnson dealers can fill every need that exists . . . can meet it *exactly,* with a size and model that is right. Johnson-built AQULUX WATER HEATERS, for example are built for every hot water problem that can arise . . . from a 500-room hotel to a 5-room house.

Johnson Oil Burners

Builders of fine Oil Burner Equipment since 1903

S. T. JOHNSON CO.
940 Arlington Ave., Oakland 8, Calif.
401 No. Broad St., Philadelphia 8, Pa.



FIVE LITTLE PIGS at the Profit Trough

Here they are . . . cold checks, thin walls, irregular walls, imperfect threads, bad chamfers . . . each and every one of them eternally eating profits because of call-backs.

How to stop them! That's easy. Confine your fitting sources to responsible jobbers and you'll be supplied perfect fittings only.

"K" fittings are precision built, thoroughly inspected, and in stock at responsible jobbing houses exclusively.

Complete Line. Catalog on Request.
Standard and extra heavy cast-iron screwed fittings.
Standard flanged fittings.
Standard and extra heavy companion flanges.
Drainage fittings.

"K" fittings are carried in stock at Malleable Iron Fitting Co., Branford, Conn.; M. I. F. stocks at Kuhns Bros. Co., Dayton, Ohio.

KUHNS BROTHERS CO.
DAYTON 7, OHIO

The General Says

ATTENTION

Write today for the complete information which General Blower Co. has prepared for you regarding

GENERAL MULTIBLADE EXHAUSTERS

Ask for Portfolio SC-101—H.P.A.

DELIVERIES 2½ WEEKS

GENERAL BLOWER COMPANY

Producers of Air Moving Equipment

401 North Peoria St. Chicago 22, Illinois

tools; and wire strippers. There are many photographs, tables, and dimensional drawings.

Piping in Industry

No. 5063—Piping's part in the development of industry during the last 90 years is the story told in a 112 page issue (Vol. 42, No. 3) of the Valve World, published by the Crane Co., 836 S. Michigan Ave., Chicago 5, Ill. The contribution of piping is traced in the following industries: petroleum; steelmaking; pulp and paper; chemical processing; railroads; gas; textiles; canning and bottling; rubber; shipbuilding; meat packing and dairying; plastics; mining; waterworks and sewerage systems; building construction; and machinery.

Safety and Relief Valves

No. 5064—A four page bulletin (502-A) issued by the J. E. Lonergan Co., 2nd and Race Sts., Philadelphia 6, Pa., describes safety and relief valves, pressure indicating gages, and specialties such as air and steam whistles. Typical models are illustrated and essential specifications are listed in tabular form.

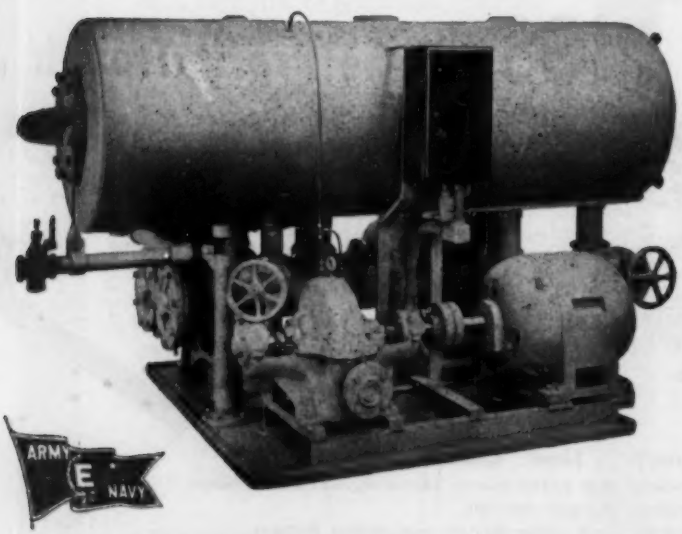
Spray Nozzles

No. 5065—Photographs and dimensional drawings illustrate the text of an eight page bulletin (450) on spray nozzles issued by the Binks Mfg. Co., 3114-40 Carroll Ave., Chicago 12, Ill. Capacity tables, spray characteristics, and construction details are included.

Stokers

No. 5066—An 11 page booklet issued by the U. S.

Boiler Feed Pumping Units



ARMY E NAVY

A star has been added to the "E" Award for Walter H. Eagan Company's high achievement in the production of Condensate Return Units.

- For use where boiler feed should be controlled by boiler water level.
- Where operation of boiler water make-up condensate return is combined.
- In process steam installations where little condensate is returned.

This is one of the various types of Condensate Return Units manufactured by Walter H. Eagan Co. No matter what your requirements, there is an Eagan Unit to do the job.

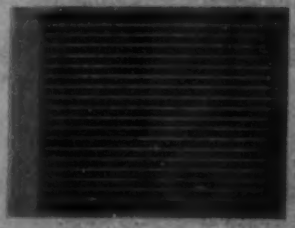
Write for General Catalog No. 2
Consult us on your requirements

WALTER H. EAGAN CO.

2336-38 FAIRMOUNT AVENUE, PHILADELPHIA, PA.

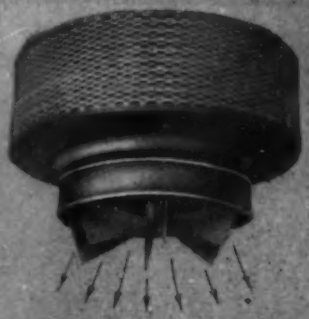
McCORD
HEATING AND AIR CONDITIONING PRODUCTS

BLAST HEATING COILS—AIR CONDITIONING COILS—ALL TYPES



All copper spiral fin tube construction with the tubes formed or bent permits uniform expansion without strain. Headers are heavy wall construction with tubes brazed into extended ferrules formed in the headers. Fins are helically wound and metallically bonded. May we send catalog?

VERTICAL TYPE UNIT HEATERS



A proven heating unit, modern in design, incorporating every unit heater advancement. McCord copper spiral fin tube construction creates air turbulence without undue restriction. Improved fan blades deliver large volume of air with minimum air noise. Guaranteed for 150 lbs. saturated steam pressure. Specify McCord.

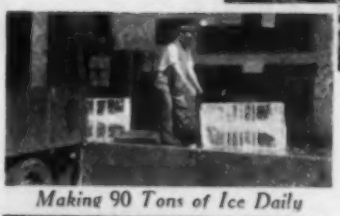
HORIZONTAL TYPE UNIT HEATERS

A time proven heating unit, modern streamlined in design, quiet, yet its rugged construction adapts it to all types of installations, guaranteed for use on No. 150 p. s. i. steam pressure. All copper heating element, individual spiral fin tubes free to expand without strain on joints. Standard motors with standard bases used. Wide range of capacities.

Save fuel with McCord Unit Heaters.

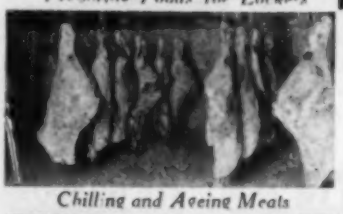
McCord CORPORATION
DETROIT 11, MICH.

Air View of the Consumers Ice and Coal Co., Lancaster, Penna.



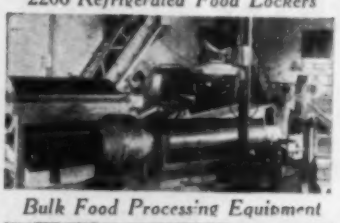
Making 90 Tons of Ice Daily

Preparing Foods for Lockers



Chilling and Ageing Meats

2200 Refrigerated Food Lockers



Bulk Food Processing Equipment

4 Frick Blizzard Freezers

Packaging Frozen Foods

Frozen Food Storage

Another Highly Successful Community Refrigeration Center

The Consumers Ice and Coal Co., Lancaster, Penna., provides refrigeration service to more than 2500 customers. • The plant has been making ice for over 40 years; now produces 90 tons daily, serves town and country routes, and ices refrigerator cars; but ice comprises only one-fifth of its business. • Its locker system is one of the largest and finest in the country; is complete with processing equipment, chilling and ageing rooms, quick-freezer, and 2200 food compartments; it also has 3 substations in nearby towns. • Thousands of pounds of locally grown fruits and vegetables are cleaned, graded, quick-frozen, packaged, and sold under the "Consumers" label, each season. Four Blizzard freezers handle this load. Six freezer storage rooms hold 3 million lb. of various frozen foods. • Fresh fruits (up to 75,000 bushels) are stored, not to mention carloads of such products as cheese, cream, cabbage, meats, potatoes, etc. • Frick refrigerating, ice-making, quick-freezing and cold storage equipment is used throughout. • A similar COMMUNITY REFRIGERATION CENTER could be of great service to YOUR town. Get in touch with your nearest Frick Branch Office, or write direct to

Frick Company
Waynesboro, Penna.

INSTALL
HEATING EQUIPMENT
THAT WILL LAST
FOR YEARS
GRID
UNIT HEATERS
HIGH TEST
CAST IRON
HEATING
SECTIONS
"One-piece construction heating sections (patented) of high test cast iron that will withstand steam pressures up to 250 lbs.
*No soldered, brazed, welded or expanded connections to become loose or develop leaks.
*No electrolysis to cause corrosion, break-downs, leaks or heating failures.
It's the material that makes a difference in Grid Unit Heaters. That's why they are free from maintenance expense. Many units in operation 15 years without any maintenance. Capacity tables upon request.
New booklet "Corrosion in Unit Heaters" contains information you should know before you install unit heaters—free upon request.
HIGH TEST CAST IRON UNIT
ONE PIECE CONSTRUCTION
NOTHING TO BECOME LOOSE
NO SOLDERED BRAZED, WELDED OR EXPANDED CONNECTION
D. J. MURRAY MANUFACTURING CO.
WAUSAU • WISCONSIN

Machine Corp., manufacturer of "Winkler" stokers, contains the story of the corporation's home in Lebanon, Ind. This booklet has been compiled as a welcome to the plant and to the city. A business map of the city is reproduced, as well as a road map of central Indiana. Financial institutions, transportation facilities, places for recreation and entertainment are listed, together with other notes of interest about the city and the manufacturer.

Underfeed Stokers

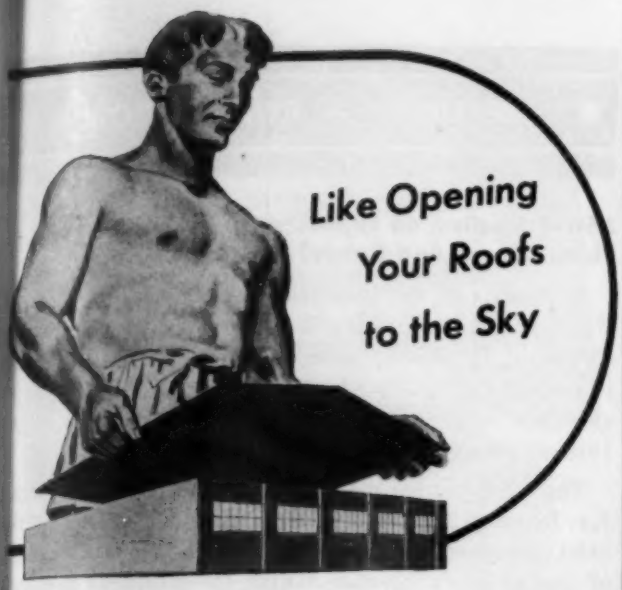
No. 5067—An eight page bulletin (1008A) issued by the Flynn & Emrich Co., 301 Holliday St., Baltimore 2, Md., describes "F&E Series 40" commercial type underfeed stokers for anthracite and bituminous coal. Sizes and capacities are listed in tabular form, and the text is illustrated with sectional line drawings and photographs.

New Testing Laboratory

A well equipped 1500 square foot laboratory in nearby Mentor, Ohio, for the testing of appliances under conditions of manufactured gas consumption is the latest addition to the research facilities of the Bryant Heater Co., 17825 St. Clair Ave., Cleveland 10, Ohio. The laboratory is supplied with coke oven gas of 530 Btu with a specific gravity of approximately 0.4.

All new product development of the company will be thoroughly tested on both natural and manufactured gas with the aid of these new facilities, as will its furnaces, unit heaters, and boilers.

3-WAY GUARANTEE OF DEPENDABLE PERFORMANCE
Hydrovac
Super Vacuum Return Units
Not one, not two, but three guarantees highlight the quality and performance of Hydrovac units.
1. 3-year wear-proof guarantee.
2. Guarantee of a minimum of 25 inches of vacuum at 70° F. against a sealed inlet.
3. Guarantee that vacuum will not recede to zero, with unit at rest, in any time under 5 hours.
Note these features of Hydrovac's exceptional design and construction:
(1) Permoy Cast Iron Receiver; (2) Bronze Internal Parts; (3) Extra Large Shielded Bearings; (4) No Vacuum at Stuffing Box; (5) All facings machined; (6) Stainless Steel Rods; (7) Dash Pot Mechanical Valves; (8) Stainless Steel Bushings; (9) Wide Clearance Between Working Parts.
Get All the Facts Back of Hydrovac's Triple Guarantee. Write for the 4-page Bulletin 100-B.
AMES HYDROVAC INC.
290 SCHOLES STREET BROOKLYN 6, N. Y.



Speed Inefficiency OUT of Industrial Buildings

by Swartwout *AIRMOVER* "Open Roof" Ventilation

Wise industrial management knows that thousands of dollars worth of lost time, lost motion and spoiled work are saved by keeping employees comfortable. AIRMOVER provides speedy removal of excess heat, smoke, fumes and fog without power, without maintenance. Covers most of the roof, if needed, or areas most seriously affected. Installs on any type of roof without complicated construction — looks neat, business-like — does a job any architect or engineer can be proud of. Write for complete information.

The Swartwout Company
18511 Euclid, Cleve. 12, Ohio

Swartwout Specialists in Air Movement by *Natural* Methods

for Steel Pipe

"EVERY wise steel pipe customer looks for the brand name he knows best, and whose quality has proved best. In buying WHEATLAND, you get a name well-known, and a product well-proved."

"As each piece of black pipe is separately passed through a great octopus-shaped coating machine, it is thoroughly sprayed with quick-drying lacquer. Before the coating process, every length is cleaned, descaled and inspected."

"Thus, WHEATLAND black pipe is guarded from surface injury by a protective clothing, readying it for long life in heating systems and installations, air-conditioning, etc."

Plant: Wheatland, Mercer County, Pa.
General Offices: Real Estate Trust Building
Philadelphia 7, Pa.

WHEATLAND TUBE COMPANY

PIPE AND TUBE
BENDING, WELDING, FABRICATION

Many foremost manufacturers, having discovered our specialized skill in our particular line, have entrusted us with a great variety of precision pipe and tube work, including bending, coiling, expanding, flattening, brazing and welding.

Swan engineers and technicians, dealing continually with piping, can advise on your bending requirements and offer valuable suggestions on design and economical methods of installation. We invite your inquiries.

SWAN ENGINEERING COMPANY, Inc.

746 Frelinghuysen Avenue — Newark, N. J.

MEETINGS & CONVENTIONS

ASHVE Studies '46 Exposition, Plans Council and Annual Meeting

A meeting of the council of the American Society of Heating and Ventilating Engineers has been called in Cleveland, October 7, 1945, at which time it is planned to inspect the society's research laboratory. The Northern Ohio chapter will hold its opening meeting of the 1945-46 season on October 8.

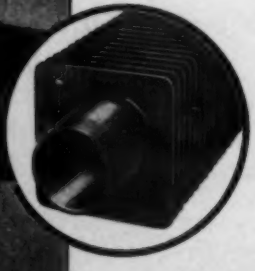
The 52nd annual meeting of the society is scheduled for January 28, 1946, in New York City. One of the most important matters to be considered is a revision of the society's charter, which its attorneys are now preparing in order to modernize this instrument and make it effective in connection with the extended research program that is to be undertaken.

At the council meeting last May, the executive committee of the society was authorized to arrange for an exposition in January 1946 if such a plan was feasible, and a survey is now being made by the exposition management to determine whether exhibitors wish to exhibit at that time.

The headquarters office of the ASHVE is at 51 Madison Ave., New York 10, N. Y.

DIFFUSED HEATING . . . *for Comfort*

● Heat by convection with no stratification of air. No hot or cold drafts with temperature distribution surprisingly uniform. That's VULCAN . . . the finned tube radiation used as a complete heating unit or as a supplemental heating and conditioning system. In addition to Schools (as illustrated) Vulcan is found in Industry, on Ships, in Hospitals, Churches, Theatres, Auditoriums and Homes.



Condensed catalog Number 25 with Engineering data is now ready and is yours for the asking.

Look for the name
VULCAN-HARTFORD
It is stamped on every radiator.

Representatives in Principal Cities

THE VULCAN RADIATOR CO. 26 FRANCIS AVENUE, HARTFORD 6, CONN.
RADIATOR MANUFACTURERS FOR OVER TWO DECADES

Breidert Air-X-Hauster CHIMNEY TOP

The greatest scientific improvement in Ventilators in over 50 years

TYPE B-2 CHIMNEY TOP

Eliminates smoking fireplaces caused by down-draft

By stopping all down-drafts (interior negative pressure excepted), a Breidert Air-X-Hauster on the chimney absolutely prevents the fireplace from smoking and damaging furnishings. *It provides positive "draw" regardless of wind direction!* Scientifically designed to convert *any* wind current into a powerful suction force, the Breidert remains stationary, has no moving parts. Successfully in use in all parts of the country.

Old Method — Breidert Method

TESTED AND CERTIFIED . . . Thoroughly tested by Smith, Emery & Co. (Pacific Coast branch, Pittsburgh Testing Laboratories) with wind blowing at *all* angles, the Breidert's amazingly high capacities are fully certified.

Breidert Air-X-Hauster Roof Ventilators and Vent Flue Caps

The remarkable ability of the Breidert Air-X-Hauster to provide positive ventilation no matter which way the wind blows, has been proved in thousands of installations throughout the country. Properly installed, the Breidert has *never* failed to fully meet every claim made for it!

TYPE A FOR ROOF — TYPE B VENTILATING — VENT FLUE CAP

WRITE FOR FREE ENGINEERING DATA BOOK . . . containing specifications and installation data, certified capacities, etc. Address Dept. S.

G. C. BREIDERT CO.

634 South Spring St., Los Angeles 14, California

REPRESENTATIVES LOCATED IN PRINCIPAL CITIES OF THE U. S.

WRAPPED IN A BLANKET OF GLASS

"Fiberglas" Insulation is packed around pipe in Adsco-Bannon Tile Conduit

Steam Carried Long Distances with Minimum Heat Loss

For a simple, convenient, easy to use conduit and insulation for underground steam lines that can't be beat for thermal efficiency, install ADSCO-Bannon Tile Conduit with ADSCO Filler Insulation (a "Fiberglas" product).

This combination will give you everything you need to do the kind of job that will satisfy your customers and bring you plenty of credit.

Thanks to its split tile construction that makes it easy to thread or weld a pipe or group of pipes, you won't require highly specialized technical skill or labor.

ADSCO-Bannon Tile Conduit is furnished for several combinations of pipes in the same conduit—has a base drain that carries away ground seepage, keeps insulation dry and prevents undue heat loss. For a permanent job at the right price you can depend on ADSCO-Bannon Tile Conduit and Insulation every time. Write for quotation and Bulletin No. 35-67HP.

AMERICAN DISTRICT STEAM COMPANY
NORTH TONAWANDA, N.Y.

MAKERS OF "UP-TO-DATE" STEAM LINE EQUIPMENT FOR OVER 65 YEARS

ADSCO-BANNON
TILE CONDUIT
WITH ADSCO FILLER INSULATION
(a "Fiberglas" Product)

THE UNIONS WITH THE RECESSED BRASS SEAT

JEFFERSON SPECIALTY UNIONS

Effect Big Savings in Labor

Jefferson Union Tees with union on the outlet assure labor savings and better piping jobs because they take the place of an all-female union, two nipples and an ordinary tee. Three joints are thus saved. Available in All-Female and Male and Female threads.

The brass seating in these and all Jefferson Specialty Unions is an exclusive feature which, located in a recess away from the runway of the fitting, leaves a straight bore assuring unrestricted flow in the pipe.

JEFFERSON UNION CO.

601 West 26th Street, New York 1, N. Y.

Factories at

Lexington 73, Mass. Lockport, N. Y

Smoke Prevention Association To Meet in October

The Smoke Prevention Association of America, N. Clark St., Chicago 2, Ill., will hold a fall interim ference in Columbus, Ohio, October 16, 17, and 18, 19 In arranging the speaking program, the program co mittee has recognized the value of smoke prevention a means of conserving fuel, and is emphasizing necessity of actively promoting enforcement of sm regulations to insure adequate fuel supplies during coming winter.

The following subjects are to be discussed: the efficiency campaign and its effect on smoke abatem efforts; district and central heating and their effect

TEMPLETON RETURN STEAM TRAPS

for Pumping Boiler Feeding, Draining, Heating and Vacuum Lines

Pumps Water at any temperature or pressure.

Open float cannot burst or waterlog.

Valves and Seat Bronze or Stainless Steel.

Sizes 1 in. to 4 in. inlet and outlet.

Capacity 2500 lbs. to 60,000 lbs. water discharge per hr.

Ask for catalogue and prices

TEMPLETON BROS., INC.

699 Main St. Walpole, Mass.

QUALITY Always wins! MARTOCELLO Products are fully DEPENDABLE

ATOMIZING SPRAY NOZZLES, SPRAY POND NOZZLES, and CONDENSER WATER DISTRIBUTORS

For Vertical Shell and Tube Ammonia Condensers

ALL MARTOCELLO SPRAY NOZZLES are manufactured with precision and of a design which has been thoroughly tested for maximum results and durability. They are guaranteed to give satisfaction. Successful, efficient results depend largely upon selecting the proper number, type and size of Nozzles suitable for your installation.

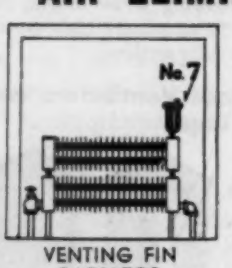
THE MARTOCELLO CONDENSER WATER DISTRIBUTORS are now used as standard equipment by Progressive Refrigerating Engineers in solving their Manpower problem, because they require no attention and assure users of the lowest Condenser Operating Pressures and Minimum Power Cost.

It will pay you to consult us. WRITE or WIRE for further information.

Jos. A. Martocello & Co. 1-3 NORTH 13th STREET PHILADELPHIA 7, PA

and keep it out with

AUTO-VENT AIR ELIMINATORS



VENTING FIN RADIATOR

Circulation Troubles?

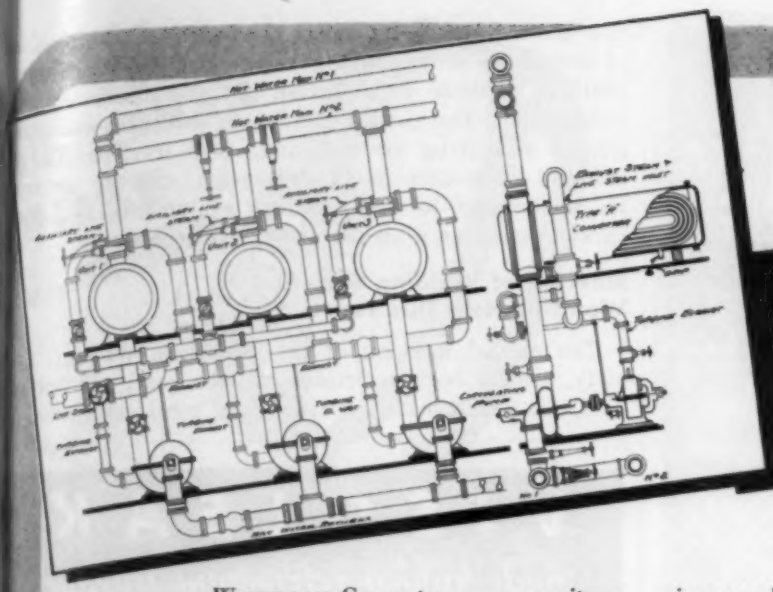
Don't fight air pockets or traps in hot or cold circulating lines. "Get that air out of there" *and keep it out* simply by installing the No. 7 Maid-O'-Mist Automatic Air Vent. This reliable air vent has a self-closing float-controlled valve and is designed especially for circulating pipe lines, convector radiators, unit heaters, cooling manifolds, tanks, diesel engines, or any other application where air pockets or traps retard the free circulation of liquids. For pressures up to 75 lbs. Now available in bright brass finish.

APPROVED FOR NAVY, MARITIME COMMISSION AND ARMY USE

MAID-O-MIST INC.

AUTOMATIC HUMIDIFIERS OF ALL TYPES FOR HEATING SYSTEMS

3215 N. PULASKI RD., CHICAGO 41, ILLINOIS



for

SPACE HEATING SYSTEMS USING HOT WATER

WHITLOCK CONVERTORS

WHITLOCK Convertors . . . gravity or forced circulation . . . save fuel and deliver full heat rating, year after year. The WHITLOCK forced circulation system above utilizes exhaust or live steam and has as advantages—small pipe sizes can be used, saving critical material; heating water may be efficiently carried long horizontal distances; relatively heavy overloads are easily handled; attendance costs are eliminated. Don't wait—order your heating equipment now!

LET US KNOW YOUR REQUIREMENTS

The **WHITLOCK MANUFACTURING COMPANY**

44 SOUTH STREET, ELMWOOD, HARTFORD 1, CONN.

NEW YORK BOSTON CHICAGO PHILADELPHIA DETROIT RICHMOND

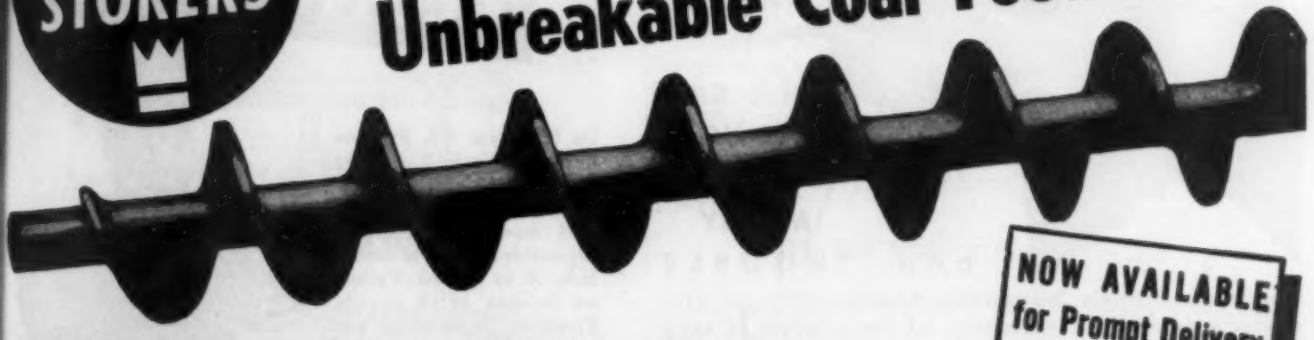
Authorized representatives in other principal cities.

In Canada: Darling Brothers, Ltd., Montreal

ESTABLISHED 1891 . . . AHEAD OF THE TIMES FOR HALF A CENTURY

For **STOKERS**

The CROWN Unbreakable Coal Feed Screw



NOW AVAILABLE for Prompt Delivery

WELDED All-Steel Worm—All Sizes—All Pitches

★ Crown's complete line of all-steel Coal Feed Screws meets every replacement and production requirement. Produced for both domestic and industrial stokers. Crown Screws are available with right or left hand screws, in all sizes and pitches, tapered or straight, and in combinations of pitches. Uniformly smooth surfaces insure that coal will flow freely and easily through the flights. Because it is all-steel with continuous weld, the Crown Coal Feed Screw guarantees long, continuous operation with full customer satisfaction. Crown is in a position to make prompt delivery on all sizes.

In ordering give complete specifications on size and design.

CROWN IRON WORKS COMPANY

1202 Tyler St., N. E. *Since 1878* Minneapolis, Minn.

the smoke problems of urban communities; elimination of nuisances accompanying refuse and garbage incineration; methods of collection of solid discharges resulting from fuel combustion; standardization of methods of measuring air pollution; new developments in railroad locomotive smoke prevention; overfire air and its application to fuel burning equipment; and coal carbonization as a smoke preventive measure.

Meeting of Welding Society Won't Be Held This Year

The annual meeting of the American Welding Society, usually held in October of each year, will not be held this year because of travel and hotel conditions. A

"COMMERCIAL" VENTURI TYPE FAN HOUSING

Twelve sizes now available ... free from die charges.

Venture section and support plate are formed in one piece ... no folds or welds.

These sections are formed cold ... dimensions are uniform.

Write for folder giving full dimensions.

THE COMMERCIAL SHEARING AND STAMPING COMPANY
YOUNGSTOWN 1, OHIO

VISOLEAK
finds hidden refrigerant leakage

Detects leaks in refrigeration equipment before they cause damage to expensive installations and loss of costly products.

Years of use have proven ***VISOLEAK*** to be dependable, economical, safe and easy to use. See your refrigeration supply jobber or write for complete information.

WESTERN THERMAL EQUIPMENT CO.
5141 ANGELES VISTA • LOS ANGELES 43, CALIFORNIA

FREDERICK STOKER
WITH *FULLY ACTIVE* GRATE SURFACE

. . . CAN SAVE YOU TIME, MONEY *and* TROUBLE

Operators of Hotels, Institutions, Apartment Houses, etc., economy minded but thoughtful of the comfort of their clientele, can get *more* heat and burn *less* coal with a Frederick Stoker. The Frederick requires very little attention. More grate area . . . maximum combustion and full utilization of heat giving gases, produces the highest number of heat units from every pound of coal consumed. Engineering consultation available without obligation.

Frederick also manufactures fine Centrifugal Pumps . . . guaranteed to do the work for which they are sold.

THE Frederick IRON & STEEL CO.
Frederick, Maryland

STOKER SPECIALISTS SINCE 1918

EFFICIENT ECONOMICAL

De Luxe type WK Pressure Actuated Water Regulating Valves for Freon, Sulphur or Methyl, are pilot operated, modulating. Standard adjustable opening range from 50 to 150 lbs. Factory set to open at 90 pounds. Precision engineering and individual testing for low cost, satisfactory performance. Available in sizes of ¾ to 2 inches FPT. Simple adjustment—easily serviced.

Other sizes and types are also available.

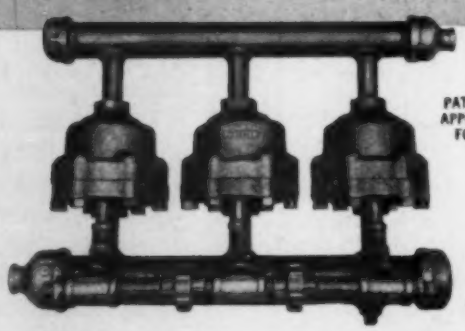
Electrimatic
2100 INDIANA AVE. CHICAGO 16, ILL.

THE *New* TINNERMAN HOSE CLAMP

This one-piece, ratchet type Hose Clamp is easily latched by hand, then quickly locked with pliers. Removed by prying locking tongue out of ratchet teeth with screwdriver. It weighs less, has a lower profile, exerts uniform pressure, and may be used over and over again. Approved by Army and Navy Air Forces. Sizes from ½" O.D. up. Write for details.

TINNERMAN PRODUCTS, INC.
2018 Fulton Road, Cleveland 13, Ohio

Purify Any Pressures, Air or Gas, with Bird-White Multiple Unit *Pur-O-fier*



PATENT APPLIED FOR

Three Models Available

Model A-1 furnished with a 1 inch turbo-rotor and will accommodate volumes from 1 to 8 cubic feet.

Model A-2 has a 2 inch turbo-rotor and can accommodate volumes from 10 to 35 cubic feet.

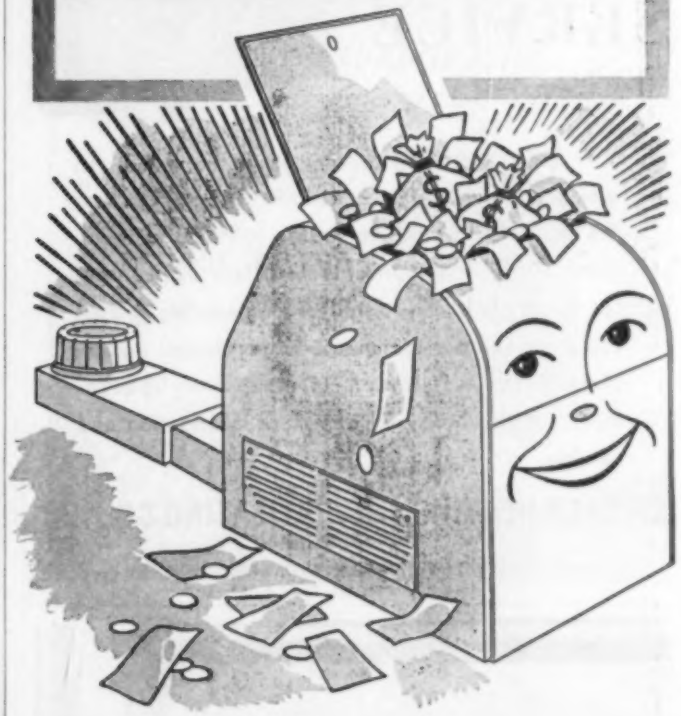
Model A-4 has a 4 inch turbo-rotor and can accommodate volumes from 35 to 100 cubic feet.

Bird-White multiple unit Pur-O-fiers save time and money by protecting air-operated machines, gauges and controls from contamination. They give positive purification to air or gas lines regardless of fluctuating pressures or high volumes.

The perfectly balanced Turbo-Rotor purifying action makes them sensitive to both regular and intermittent pressures. Write for Bulletin 10 giving complete details.

BIRD-WHITE COMPANY
Dept. HP, 3119 W. Lake St., Chicago 12, Ill.

"THE STOKER FULL O' MONEY!"



Yes sir . . . the Peerless Fire-Guard Stoker is a real financial windfall. Designed and engineered to give the utmost in Stoker satisfaction . . . this quality product means sales . . . sales . . . and more sales! !

They're real honest-to-goodness sales too . . . for all the prestige and backing of the vast Peerless organization stands behind you . . . and each Fire-Guard Stoker you sell!

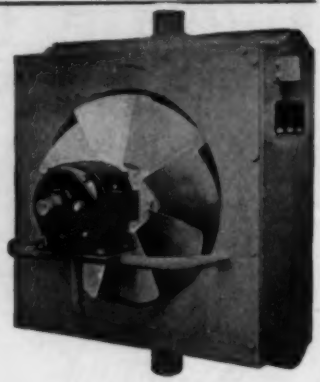
Take advantage of a few choice and exclusive territories still open . . . wire, phone, or write today for complete details!

PEERLESS FIRE-GUARD STOKERS

Peerless
MANUFACTURING CORPORATION
INCORPORATED
LOUISVILLE, KENTUCKY
SINCE 1884

"Quality First" Skinner Unit Heaters with ALL-STEEL COILS Since 1914

FOR LONGEST SERVICE



SKINNER Unit Heaters have been built to give the longest service possible. They will outlast the pipes that furnish hot water or steam to them. Since 1914 Skinner Unit Heaters have been known for quality in every detail of engineering, manufacturing and performance. Skinner builds a complete line of unit heaters to meet every requirement. Write today for complete information and catalog.

SKINNER HEATING and VENTILATING CO., INC.
Division of
ST LOUIS BLOW PIPE AND HEATER CO., INC.
1948 N. 9th St., St. Louis 6, Mo.

meeting of the national officers, the board of directors and committee chairmen will be held in New York at the Hotel Pennsylvania, October 18, to deal with matters which require official action that cannot be delayed. This group will also present the society prizes, medals and other awards which have been given in past years at the opening sessions to those who have made outstanding contributions in the advancement of the science of welding.

The program committee of the society has arranged for the presentation of the papers prepared for the annual meeting in the Welding Journal, the society's monthly magazine. Discussion on these papers will also be presented in the journal.

MOREY FLOAT VALVE
DESIGNED FOR COOLING TOWERS AND EVAPORATIVE COOLERS
HAS MANY OTHER USES

LIST PRICE $2.00

SIMPLE IN OPERATION
EASY TO CLEAN

Materials corrosive resistant. IRIDITE PLATED. Non Water Absorbing POLYSTERENE FLOAT. Will flow 70 G.P.H. at 20-lb. Pressure, 195 G.P.H. at 80 lbs. Packed in cartons of 12. Usual Trade Discounts.

SEND FOR SAMPLE

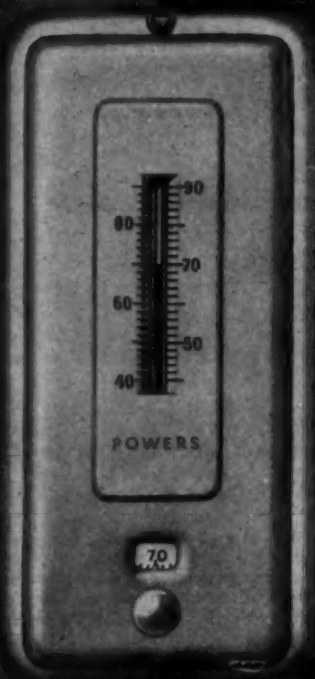
DAN MOREY
814-816 S. ROBERTSON BLVD. LOS ANGELES 35, CAL.
TELEPHONE CRESTVIEW 5-3351
ALSO MANUFACTURER of MOREY'S PRECISION
Evaporative Cooler (Mats) Pads — Send for Price List

The Pipe Joint Cement that never hardens

Do the job with Rutland Pipe Joint Cement, and pipes are always easy to disjoin. Rutland seals joints tightly and lasts indefinitely, too. Saves money because more bulk per pound. Remains soft in can. Does not stain hands or fixtures.

Mail post card for free sample. Rutland Fire Clay Co., Dept. H-29, Rutland, Vt. Also makers of Rutland Retort Cement, Furnace Cement, Asphalt Paint, Concrete Patcher.

GRADUAL CONTROL

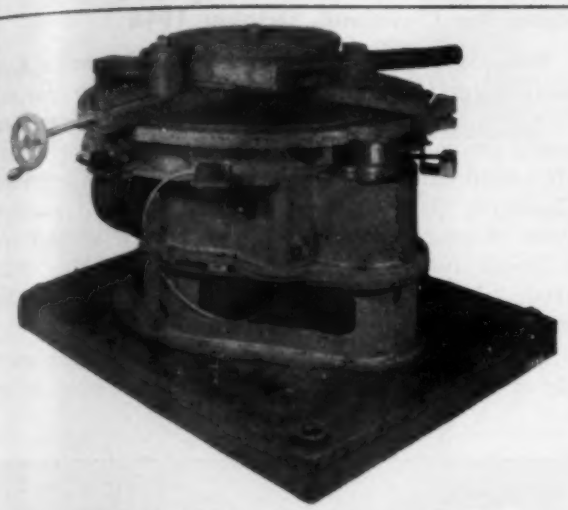


has been an outstanding feature of Powers regulation since 1891. With this type of control, valves or dampers are opened or closed **gradually**, which results in exceedingly close regulation and the maximum of comfort obtainable with automatic control.

● THE POWERS REGULATOR CO., 2759 Greenview Avenue, CHICAGO. Offices in 47 Cities. See your phone book. ●

WRITE FOR BULLETIN NO. 200

POWERS TEMPERATURE and HUMIDITY CONTROL



7 REASONS WHY YOU SHOULD OWN A PEDRICK PRODUCTION BENDER

1—It will bend pipe to compound systems in multiple planes.
2—It will bend serpentine coils of finned or plain tube.
3—It will bend box coils of finned or plain tube.
4—It will bend helical coils of pipe or tube.
5—By the addition of a few inexpensive controls, it can be made to do all of this work automatically.
6—It will do all this work at production speeds.
7—High production means low cost production.

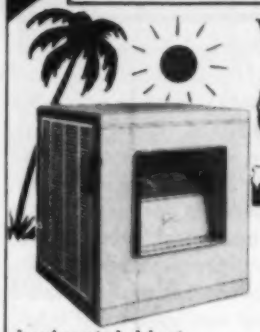
To realize greater profit, bend your pipe and tube on a Pedrick Production Bender.
No heat or internal mandrel required.

PEDRICK TOOL & MACHINE CO.
3640 N. Lawrence St. Philadelphia 40, Pa.

The "comfort business" pays all year round when you sell

PALMER PRODUCTS

When it's hot . . .



SNO-BREZE
EVAPORATIVE COOLERS

horizontal blast blower type cooler

When it's cold

PALMER FURNACES

All sizes and types of coolers and gas furnaces. Write for free literature and prices.

suspended unit heater

Palmer MFG. CORP. • PHOENIX, ARIZONA

The High Efficiency of . . .

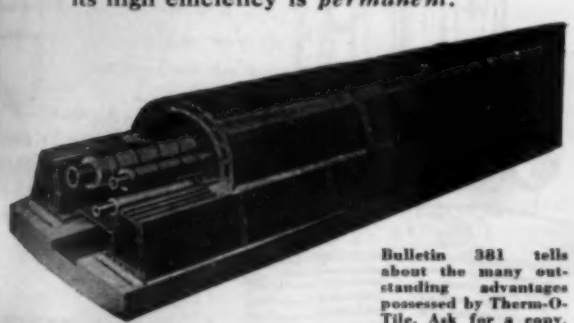
THERM-O-TILE

Reg. U. S. Pat. Off.

Underground Pipe Conduit Is

PERMANENT

Therm-O-Tile insulation is always *dry*—and the original correct grade is always *maintained*. That's why its high efficiency is *permanent*.



Bulletin 381 tells about the many outstanding advantages possessed by Therm-O-Tile. Ask for a copy.

Sold and installed by Johns-Manville Construction Units in all Principal Cities. See Sweet's Architectural File, or, The Heating Guide.

H. W. PORTER & CO., Inc.
822-H Frelinghuysen Ave. Newark 5, New Jersey

---

5 to 12 in.

These Illustrations Show the Patented Construction of a Janette Wheel. The blades are formed in pairs for rigidity. The blade slots in the steel discs are die cut to ensure exact spacing of the blades. The hub is riveted to the back plate; then the blades are inserted into the slots. After the blades are spot welded to the back plate the tips are pressed thru the slots of the inlet disc, then rolled down against the disc.

The Inherent Spring of the Blades Keeps Them Tight.

Because of This Construction, Janette Wheels have given over 19 years of universal satisfaction to internationally known manufacturers of coal stokers, blowers, ventilating equipment, air cooled engines, oil burners, superchargers, dust collectors, drying and fire detection apparatus. **It Will Pay You to Give Janette Blower Wheels a Trial!**

May We Send Literature?

Janette Manufacturing Company
556 W Monroe St Chicago 6 Ill

Old Fittings Can Be Re-used When Sealed with KEY-TITE

Fittings or joints sealed with Key-Tite can be reopened without damage to the threads as Key-Tite positively will not "freeze" the joint. Key-Tite remains unchanged in formula, and is an ideal, leak-proof sealer for lines carrying water, gas, compressed air, etc. It does not affect the color or taste of potable liquids and contains no lead nor lead substitutes.

Key-Tite is much more economical to use than ordinary pipe dopes as it gives greater coverage.

Put Key-Tite to the test. Send for a generous free sample or order from your jobber.

THE KEY Company

2617 McCasland Avenue East St. Louis, Illinois

Refrigeration, Air Conditioning Show Slated for Cleveland, October 1946

The board of directors of the Refrigeration Equipment Manufacturers Association, meeting in Marinette, Wis., the day the Japs quit, decided that the association would resume its annual all-industry refrigeration and air conditioning show in the municipal auditorium in Cleveland, October 28, 29, 30, 31, and November 1, 1946. A quarter of a million square feet of floor space, sufficient for at least 250 separate exhibits, will be used, "thus making the display at least three times larger than any held before the war."

In an effort to solve the problem of an adequate supply of raw materials, a special meeting of the 80 mem-

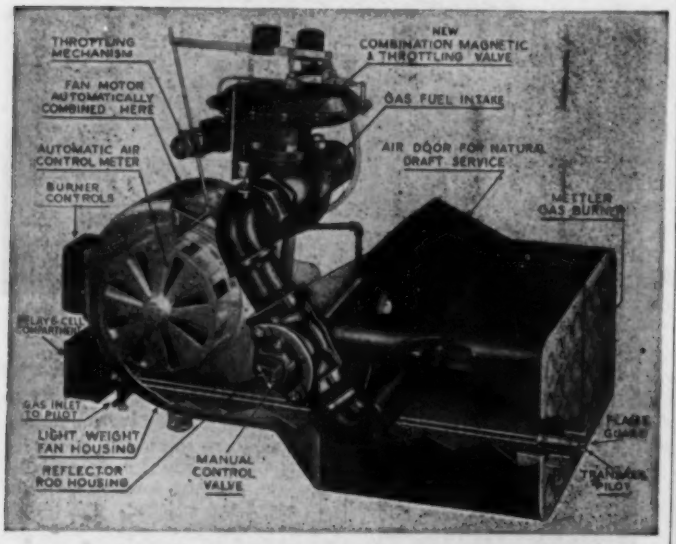
AUTEMPCO MOTORIZED VALVES

Originators of Electronic Controls for Heating Systems

INDOOR-OUTDOOR TEMPERATURE CONTROLS

AUTEMPCO CORP., 521 Fifth Ave., New York 17, N. Y.

The Mettler "FAN-AIR" Gas Burner



Picture reveals essential & highly desirable POINTS of Fan-Air mech'l draft gas burners. Not just a gas burner but a COMPLETE AND FULLY AUTOMATIC BURNER SYSTEM, factory tested and ready for application when received. Its the most modern gas burner and easier to install.

(NOTHING ELSE LIKE IT)

SIZES 5 TO 300 H.P. PROMPT SHIPMENTS

Mettler Entrained Combustion Gas Burners

FOR ALL Purposes Kinds of gas Pressures

Write for Catalog

LEE B. METTLER CO.

406 S. Main St. Los Angeles, Cal.

SUPERIORITY is the reason for the great demand, even under present conditions for

AT-A-GLANCE GAUGES

(A large new factory building is now under construction as present facilities will not meet post-war demands.)

SOME POINTS OF SUPERIORITY:

1. Can be easily installed in partially filled tanks.
2. Listed as Standard by UNDERWRITERS LABORATORIES.
3. Made in sizes to fit any standard tank.
4. Easiest reading gauge on the market.
5. Simple sturdy construction.

"AT-A-GLANCE" Gauges can be purchased from jobbers throughout the United States on an AA-3 Priority.

Write for complete details today.

KRUEGER SENTRY GAUGE COMPANY

109 No. Pearl St. Green Bay, Wisconsin

Alnor VELOMETER

★ all purpose air velocity meter

Instantaneous, direct readings of air speed measured in feet per minute with the *Alnor* Velometer give you the quick, accurate information on air movement needed to check operation of blowers, fans, air conditioning installations, and similar equipment. No calculations, no timing, no conversion tables; read velocities direct from the Velometer scale. Extension jets permit accurate readings in many locations that would be completely inaccessible with other means of measurement.

The Velometer is made in several standard ranges from 20 fpm to 6,000 fpm, and up to 3 inches static or total pressure. Special ranges available as low as 10 fpm and up to 25,000 fpm velocity and 20 inches pressure.

Write for Bulletin No. 2448-E.

Illinois Testing Laboratories, Inc.

419 NORTH LA SALLE STREET • CHICAGO 10, ILLINOIS

HOW DIRTY ARE YOUR FILTERS?

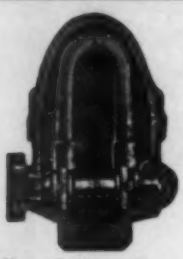
THIS GAGE TELLS

HAYS AIR-FILTER GAGE

- *Automatic*
- *EASY TO INSTALL*
- *SAVES MONEY*
- *ELECTRICALLY OPERATED*

If you are confronted with the problem of not knowing when the collected dirt in your filters is of sufficient density to decrease operating efficiency, install a HAYS Air-Filter Gage. The HAYS indicator shows amount of air resistance at all times—tells when to renew filter element—eliminates guess work—can be made to sound alarm when resistance is excessive. Write for full information. Ask for HAYS Bulletin A-F G.

The HAYS CORPORATION
COMBUSTION INSTRUMENTS AND CONTROL
MICHIGAN CITY, INDIANA, U.S.A.



Vento Radiator Trap

F & T Trap

HAINES TRAPS

for any low pressure job up to 15 lbs.

No other traps contains so many features which make for perfect service! The famous Bourdon Thermostatic Tube, for instance, is the strongest and most accurate thermostat ever built into a steam trap. Haines Traps may be examined in operation, by simply removing the cover. On the Float & Thermostatic Traps, the underslung valve principle means safety, with no danger of building up a pressure. Haines Traps cannot become air bound. They're your best bet for every low pressure job up to 15 lbs. Made in ¾", 1" and 1¼" sizes.

WM. S. HAINES & CO.
460 N. 12th Street
Philadelphia 23

DE-STA-CO

Blower Wheel Housings

of Standard Dimensions

Made in sizes to fit 4½, 5, 6, 7½ and 9 inch wheels and in widths to suit single or double inlet wheels . . . also individual parts for your own assembly.

De-Sta-Co housings are engineered for maximum efficiency and quietness in operation . . . neatly finished. Send for "De-Sta-Co Blower Housings" bulletin; gives complete information, including essential dimensions.

DETROIT STAMPING CO.
Established Over 30 Years
337 Midland Ave • Detroit 3, Mich.

bers of the association has been called for October 15, 16, and 17 at Hot Springs, Va., for the purpose of discussing with government officials immediate ways and means of getting the necessary materials. This meeting was arranged in accordance with the Office of Defense Transportation announcement permitting gatherings of 150 persons or less.

The board of directors also voiced its approval of Washington proposals designed to develop a program of cooperation between industry, labor, and the Department of Commerce for the purpose of helping all three solve current production problems and maintain employment.

HUMICLEAN

Prevents ALGAE AND SLIME IN AIR CONDITIONING

NOT A SCOURING AGENT . . .

A Proven Preventive

★ *Reduces Bacterial Content* in air going thru system from 60 to 90%.

★ *Reduces Labor* because frequent cleaning of jets and baffle plates is no longer necessary.

★ *Proved and Accepted,* has been used by large firms for over 4 years.

★ NON-VOLATILE . . . ODORLESS.

CAROLINA ANILINE & EXTRACT COMPANY

CHARLOTTE 1, N. C.

How the First National Bank Building, Detroit, cut heating and cooling load with Air Recovery Equipment.

See W. B. Connor Engineering Corp. "Aditorial" — pages 24-25

The Austin Company

INVITES APPLICATIONS FROM CAPABLE ENGINEERS AND DRAFTSMEN

This invitation is not directed to men in urgent war work but rather to those who can consider more effective effort in the present execution of vital war plants under high priority ratings, and the opportunity to participate in an increasing amount of postwar private work.

To applicants who are ambitious, straight-thinking, and of sound education and training, this company offers positions with ample opportunity for advancement on the East Coast, Central West, Gulf Coast, or the West Coast.

Positions open are for experienced mechanical designers, draftsmen and recent college graduates qualifying in—

Industrial Plant Equipment • Process Piping • Power Plants • Heating Systems • Air Conditioning and Ventilation • Conveying Systems • Plumbing and Sewers • Sprinkler Systems • Precision Machine Design

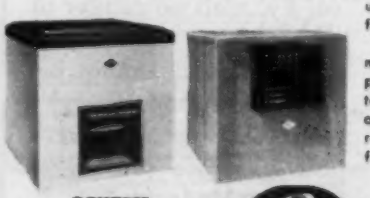
National Headquarters

16112 Euclid Avenue
Cleveland 12, Ohio

SCHELM "POLAR FREEZ"

Farsighted appliance dealers everywhere are now looking to the manufacturing experience of Schelm Brothers, Inc. to lead the parade in conditioning and freezing equipment for home and commercial use . . . to establish an even more enviable record than ever before on the famous Hall line of quality air conditioning units, low-temperature cabinets, furnace blowers and attic fans.

Prompt deliveries are now being made to dealers on these sure-fire profit-making appliances. Write today for complete information on Schelm, a name to watch and remember in the conditioning and freezing field!



SCHELM FURNACE BLOWERS

SCHELM AIR COOLING UNITS

SCHELM ATTIC FANS

SCHELM BROTHERS

Chicago Sales Office
NORTH SHORE NATIONAL BANK BLDG.
1737 Howard Street
Chicago, Illinois

"BUILDING BETTER PRODUCTS FOR 40 YEARS"